

3.0 AFFECTED ENVIRONMENT

3.1 GEOLOGICAL AND HYDROLOGICAL SETTING

The proposed SRS is located in the south-central portion of the Jornada del Muerto Basin. This is a region characterized by broad desert basins and discontinuous mountain ranges. The most significant regional geological structural feature associated with the SRS is the Rio Grande rift, which is a tensional feature in the earth's crust that extends from southern Colorado to Texas. The Rio Grande is approximately 15 miles west of the SRS. The primary geological structure within the SRS boundaries is the Jornada del Muerto syncline, which is the concave fold along the center of the Basin formed by the uplifting of the Caballo and San Andres Mountains. Figure 14 shows the principal surface geological and topographic features of the area.

The north-south trending syncline basin shows no plunge, although the top Precambrian contours reveal a structural low at roughly the center of the SRS area. The Precambrian rock rises north of this area at a one (1) degree slope and south at a 3.5 degree slope. The central basin averages 15 miles in surface width and is flanked on the east by the San Andres Mountains and on the west by the Caballo and Fra Cristobal Mountains. The mountains have opposing dips into the basin with both slopes showing Paleozoic to Tertiary beds composed predominantly of marine carbonates. This tilting is the product of late Tertiary rifting (Stickel 1991).

Although there are Cretaceous sediment outcrops along the western boundary, for the most part the SRS area is covered with a veneer of Cenozoic alluvial sediments. The Love Ranch Formation is a continental sedimentary unit that grades into or interfingers with the underlying McRae Formation. The Palm Park Formation, Uvas Basaltic Andesite, and Bell Top Formation are continental volcanic rocks with complexly interlayered sedimentary rocks and intrusive and extrusive volcanic rock layers. Camp Rice and Palomas Formations are continental valley-margin and basin-floor deposits composed of sands, gravels, conglomerates, silts, and muds. A cross section at the southern end of the SRS shows a relatively thin layer (0 feet to 1,000 feet) of these alluvial sediments at the surface (Seager 1986). This cross section

Figure 14. Geologic Setting

1 covers the area from Point of Rocks east to the San Andres Mountains. The sediment, derived from the
2 slopes of the adjacent mountains, is underlain here by Tertiary rhyolitic volcanics. The volcanics lie
3 unconformably upon an upper Paleozoic sequence of sedimentary rocks. Paleozoic rocks make up the
4 bulk of both the San Andres and Caballo Mountains. These are predominantly marine limestone and
5 dolomites. There also are shale/sand Mesozoic sequences (Kottowski 1975). The primary porosities
6 of these units are low (Stickel 1991), making distinct boundaries on the eastern and western sides of the
7 aquifer underlying the Jornada Basin.

8 The Quaternary fill sequence in the central Basin area thickens to several thousand feet in the southern
9 end of the Basin near Las Cruces. Only one small region in the SRS portrays this thickened interval. It
10 is part of a graben (a section of the earth's crust that has sunk) located south of Point of Rocks.

11 Within the proposed SRS site, the elevation averages 4,900 feet above mean sea level in the northern
12 portion and approximately 4,300 feet in the southern portion. Elevation within the portion of the San
13 Andres Mountains directly east of the site reaches 6,200 feet. Elevation in the McLeod Hills portion of
14 the Caballo range, immediately southwest of the site, is 5,100 feet. The highest peaks in the San Andres
15 and Caballo ranges are approximately 8,958 feet and 7,560 feet above mean sea level respectively.

16 The Jornada del Muerto is a closed basin, that is it has no connection with surface water outside the
17 basin. Underground water can drain to the Rio Grande. The Rio Grande floodplain, located
18 approximately 15 miles west of the proposed site, is entrenched in a valley approximately 300–400 feet
19 below the Jornada del Muerto basin (Ruhe 1967, Gile et al. 1981). Well records from the Jornada Basin
20 show that most wells in the SRS produce from the Santa Fe Group. This basin fill sequence dates from
21 Miocene to late Pleistocene. The group is not recognized as a single hydrologic unit. The water bearing
22 properties reflect the variety of deposition environments present in the basin. Bolson (a basin or valley
23 having no outlet) environments prevailed in the early stages of basin filling, whereas later stages were
24 marked by coalescence of the floors of contiguous basins and development of regional systems. Locally
25 derived piedmont slope alluvium characterized by wide textural variation including alluvial fan,
26 coalescent fan and piedmont deposits. In the closed basin, the piedmont slope alluvium grades into fine-
27 grained lacustrine (soil formed by lakes that have become extinct) and alluvial basin floor deposits.

1 Groundwater contours are available for the Rio Grand Valley and adjacent areas (King et al. 1971).
2 These contours extend only into the southern-most portion of the Jornada del Muerto Basin. No such
3 data are available for the rest of the region. These limited data for the Basin indicate that groundwater
4 flows into the basin from the surrounding mountains and from the higher elevations to the north.

5 Due to heterogeneity, hydrologic properties vary widely. The basin fill is composed of alluvial debris
6 washed from the mountains. It is marked hydrogeologically by interbedded sequences of clay, gravel,
7 and sand. Because of the structure of this portion of the basin, a lacustrine environment is indicated.
8 This would result in continuous clay deposits. The presence of these clay layers allows for a confined
9 aquifer model as opposed to an unconfined condition.

10 Water transmissivity of the Quaternary fill and Santa Fe Group ranges from 6,000 to 11,000 square feet
11 per day. Geochemically, the groundwater in the proposed SRS area has a higher total dissolved solids
12 than other parts of the Basin. In part, this is due to lesser quantities of igneous rock and also may be due
13 to slower groundwater movement. Rain falls on the mountains and higher elevations and is distributed
14 to basin fill. Recharge in the area has been estimated to be 5% of the average 9 inches per year of rainfall
15 (King and Hawley 1975).

16 **3.1.1 SOILS**

17 At least 35 soil types, including rock outcrops, have been mapped within the boundary of the proposed
18 SRS site by the Soil Conservation Service. Detailed maps and descriptions of these soils may be found
19 in the respective soil surveys of Sierra and Doña Ana counties done by the Service (Bulloch and Neher
20 1980, Neher 1984). Soil characteristics are shown in Table 9. The soil name is preceded by the U.S.
21 Natural Resource Conservation Service map symbol number for the soils within Sierra County, New
22 Mexico (Neher 1984).

Table 9. Description of Soil Characteristics

Soil Type	Permeability (inches/hour)	Water Capacity	Runoff	Water Erosion Hazard	Use
14–Armijo clay, 0% to 3% slopes	0.00 – 0.20 Low	High	Slow	Slight	Grazing, watershed, wildlife habitat
18–Berino-Doña Ana complex, hummocky	0.60 – 6.00 Moderate	High	Very slow	Slight	As above
19–Berino-Doña Ana association, gently sloping	0.60 – 6.00 Moderate	High	Very slow	Slight to moderate	As above
30–Delnorte-Cave-Tencee, moderately rolling	0.00 – 20.00 Low to high	High	Very slow	Moderate	As above
31–Doña Ana complex, hummocky	0.60 – 6.00 Moderate	High	Slow to medium	Moderate	As above
32–Doña Ana-Tres Hermanos association, gently sloping	0.20 – 6.00 Moderate	Moderate to high	Slow to medium	Moderate	As above
48–Largo, very fine sandy loam	0.20 – 2.00 Low to moderate	Very high	Slow to medium	Moderate	Grazing, wildlife habitat
49–Largo-Sotim association, gently sloping	0.20 – 6.00 Moderate	Very high	Slow to medium	Moderate	As above
55–Marconi silty clay loam, 0% to 3% slopes	0.06 – 0.60 Low	Very high	Rapid	High	As above
64–Nickel-Tencee-Delnorte complex, moderately sloping	0.00 – 20.00 Low to high	Low to very low	Medium	Moderate	Grazing, watershed, wildlife habitat
68–Reakor-Doña Ana association, gently sloping	0.20 – 6.00 Moderate	High	Slow to medium	Slight to moderate	As above
78–Stellar-Continental association, gently sloping	0.06 – 6.00 Moderate	High	Slow to medium	Slight	As above
86–Wink-Doña Ana association, gently sloping	0.60 – 6.00 Moderate	Moderate	Slow to medium	Slight	As above

Data Source: USDA Soil Conservation Service, pers. comm. 1996

1 With the exception of the Armijo clay and the Marconi soil, the site soils generally are well drained and
2 are composed of gravels, sands, sandy and loamy silts, and clays. Organic matter in these soils is low and
3 does not exceed 2%, generally being below 1%. There is no farmland under cultivation within the
4 boundary of the proposed SRS site. According to the Sierra County soil survey, none of the soils listed
5 above have qualities, moisture supply, or characteristics necessary for prime farmland (Neher 1984).

6 **3.1.2 PALEONTOLOGY**

7 Few fossils have been discovered within the boundary of the proposed SRS site. These fossils are
8 predominantly Cretaceous in age and consist of marine shell fragments, burrows, continental petrified
9 wood, stem and leaf imprints, and root traces. Scattered dinosaur bone fragments have been observed
10 in Cretaceous-age rocks a few miles west of the northwestern boundary of the proposed site, but none
11 have been found within the site boundary. No paleontological resources have been identified in those
12 rock units where construction impacts from the proposed SRS would be greatest.

13 **3.1.3 MINERAL RESOURCES**

14 The proposed SRS area has very limited leasable, locatable, or salable mineral resources. The area has
15 been explored for geothermal resources, oil and gas, coal, metallic minerals, and construction minerals.
16 The historic exploration claims and leases are shown in Figure 15. There currently are no commercial
17 prospects or production of mineral resources within the SRS boundaries.

18 **3.1.3.1 Leasable Mineral Resources**

19 Leasable minerals include oil and gas, geothermal resources, and nonenergy leasable minerals such as
20 potassium and sodium. Federal land within and adjacent to the proposed SRS has been the focus of
21 limited oil and gas exploration since the 1920s and was the subject of numerous seismic studies for oil
22 and gas in the 1950s (DOI, pers. comm., 1996). Regionally, the area was the focus of extensive
23 geothermal explorations in the late 1970s and early 1980s. Very limited subbituminous coal deposits
24 have been identified in the vicinity west and northwest of the SRS boundaries.

Figure 15. Mineral Resources

1 Six oil and gas exploration wells have been drilled in, and immediately adjacent to, the proposed SRS
2 site (Seager and Mack 1995). Two of these six wells (Prisor Unit Federal No. 1 and the Sunray Mid-
3 Continent Oil Company “M” No. 1) provided samples that indicated moderate prospects for oil and
4 gas (Cunningham 1978). The Sunray Mid-Continent No. 1 and the Burton Development Company No.
5 1 Gaume, on the eastern margin of the SRS, both disclosed thin coal beds during the oil explorations
6 at these sites.

7 Geothermal resources generally are associated with the Rio Grande rift. Several geothermal projects are
8 still active in the vicinity of Hatch, NM, approximately 20–30 miles southwest of the SRS. No thermal
9 wells or springs are known to occur within SRS. One geothermal lease existed within the southern
10 portion of the proposed SRS during the mid-1970s but was withdrawn (BLM 1996). A hot spring
11 reportedly occurs approximately 1.5 miles north of the proposed SRS (Summers 1965).

12 Coal mining has not occurred within the boundary of the proposed SRS site. The known coal resources
13 consist of a small coal field—the Engle Coal Field—located immediately west of the proposed SRS site
14 on the eastern flank of the Caballo Mountains (Figure 15). Several prospects have been opened in thin
15 lenses 8 to 15 inches thick, and drill holes have penetrated several coal beds with maximum thicknesses
16 of approximately 2 feet (NMBMMR, pers. comm., 1996). The New Mexico Bureau of Mines and
17 Mineral Resources has obtained limited subsurface information on additional coal beds located on State-
18 owned land west and northwest of the proposed site boundary.

19 *3.1.3.2 Locatable Mineral Resources*

20 Locatable commodities include metallic minerals such as gold, silver, lead, zinc, and copper and
21 nonmetallic minerals such as gypsum and fluorspar. Mining claims for these minerals are permissible
22 on public land. Historically, mineral claims have been prospected for gypsum, barite and fluorite, gold,
23 copper, uranium, and calcite (Figure 15). However, no mineral production has occurred from any of the
24 locatable minerals claims that have been filed in the SRS area.

25 A large group of placer claims within the boundary of the proposed SRS site are associated with gold.
26 This large group of claims generally lies in the western and southwestern portions of the proposed site.
27 Numerous shallow prospects for gold and copper are located near the western margin of the Point of
28 Rocks. Mineral prospecting for barite and fluorite has occurred near the southwest corner. Another large

group of claims within the proposed site is associated with uranium near the west-central portion of the site. None of these claims are active or valid (BLM 1996).

Two prospect pits located near the Point of Rocks in the south-central portion of the proposed site, named the Wilcox mine, explored a calcite vein. There has been no recent mining activity on these prospects.

The area in the southwestern corner of the proposed SRS has been prospected for gypsum and has potential for production of this resource. There is a possibility that small amounts of gypsum have been removed from the outcrops and used nearby for agricultural purposes.

One other area of mineralogical interest within and near the boundary of the proposed SRS site is the Aleman ranch where gem-quality black moss agate and petrified wood are reported to occur (DOI 1977). Aleman Ranch agate has been collected over a broad area within and adjacent to the proposed site boundary since the 1940s, when it was popularized. No claims are present at the locale. Most of this locale is northwest, rather than within, the SRS site boundary.

Fluorite, barite, gold, silver, copper, molybdenum, lead, zinc, manganese, tungsten, iron, vanadium have been found in the Caballo Mountains west of the proposed site (Kelley and Silver 1952). Of these, fluorite, barite, manganese, gold, molybdenum, copper, and vanadium have been produced in economic quantities. Low-grade iron ore occurs in large quantities in the Cambrian Bliss Formation, yet no iron production has occurred in this area.

3.1.3.3 Salable Mineral Resources

Salable minerals are “mineral materials” or commodities commonly used in construction-related activities (BLM 1993). These commodities include sand, gravel, clay, caliche, stone, and volcanic cinders. The locations within the SRS boundaries where these resources have been prospected, or developed also are shown in Figure 15 on page 95.

Small sand and gravel quarries are located within the boundary of the proposed SRS site. These pits have been for local use, such as road-fill and ranching purposes. No large-scale production or production for off-site purposes has occurred. The sand and gravel deposits within the boundary of the

1 SRS site may be up to 30 feet thick, but the total number of acres favorable for production is unknown.
2 Large-scale production of sand and gravel in the vicinity is confined to the valley of the Rio Grande
3 west and south of the site.

4 Caliche is present but it has not been used as a resource. Good construction-quality caliche has been
5 obtained by the New Mexico State Highway and Transportation Department from a caliche pit
6 approximately 8.5 miles north of the SRS. Potential for the production of construction-quality caliche
7 within the proposed site boundary is considered medium to high. Approximately 5,000 acres of land
8 are favorable for production of caliche (Figure 15 on page 95).

9 No cinder deposits are present within the boundary of the proposed SRS; one potential cinder deposit,
10 Black Hill, lies approximately ½-mile north of the boundary. Exploitable deposits of cinders are not
11 known to be present within the SRS boundary.

12 **3.1.4 SEISMOLOGY**

13 Earthquakes along the Rio Grande rift have been generated along the fault lines. The presence of a
14 geologically recent, major Pliocene-Pleistocene normal fault in the southern portion of the Jornada del
15 Muerto has been debated since the late 1970s. Geologic mapping of the Caballo Mountains and the
16 western flank of the Jornada del Muerto verified the presence of a major, through-going, normal fault
17 that trends north-northwesterly through the central portion of the proposed SRS site (Figure 14 on page
18 90). Because Jornada Draw—an axial drainage of the southern Jornada del Muerto—closely follows this
19 fault, the fault has been named the Jornada Draw Fault. Movement on the Jornada Draw Fault likely
20 occurred 2 million years ago. The current interpretation of the geologic evidence of movement along
21 the Jornada Draw Fault suggests that the fault has been inactive for a period of at least 400,000 to
22 900,000 years (Seager and Mack 1995, Seager and Mack, in press).

23 Since 1962, the majority of the 36 earthquakes detected in New Mexico with a magnitude of 3.5 or
24 greater have occurred along the Rio Grande rift. Only one documented earthquake—with a magnitude
25 of 1.56 on the Richter Scale (Sanford et al. 1981)—has occurred within or near the boundaries of the
26 proposed SRS (Figure 16). The earthquake risk for the near future for the SRS site is considered low
27 because of lack of evidence for the area in general and lack of movement along the Jornada Draw Fault
28 in particular (Seager and Mack 1995).

3.2 SURFACE WATER AND GROUNDWATER

This section discusses surface water and groundwater hydrologies and qualities.

3.2.1 SURFACE WATER HYDROLOGY

No perennial surface watercourses exist in the Jornada del Muerto Basin in the vicinity of the SRS. The hydrostatic gradient will not support springs or streams. Ephemeral surface water is derived from precipitation and storm-water runoff from the mountains and is collected in surface dirt tanks and transient ponds in dry watercourses and arroyos.

A 100-year floodplain, which represents the area that would be subject to storm-water runoff sheet flow, has been designated by the Federal Emergency Management Agency and the U.S. Army Corps of Engineers for the area. The floodplain is discussed in Subsection 3.2.1.2, beginning on page 102.

3.2.1.1 Elephant Butte Reservoir

The nearest large bodies of perennial free water are the Elephant Butte and Caballo Reservoirs and the Rio Grande, located approximately 20 miles southwest to 40 miles northwest of the SRS. Elephant Butte Reservoir is operated by the Bureau of Reclamation, with releases

Figure 16. Regional Seismicity

1 controlled by the Rio Grande Compact Commission, and is the largest body of water in New Mexico.
2 The dam containing the reservoir was constructed between 1910–1916 under the Reclamation Act of
3 1902 in order to store and supply irrigation water to the Rio Grande Project. The Rio Grande Project
4 consists of the Elephant Butte Irrigation District in New Mexico, the El Paso County Water
5 Improvement District No. 1 in Texas, and the Republic of Mexico. Elephant Butte water is stored and
6 released in accordance with the 1906 International Treaty with Mexico. The entitlement for Mexico,
7 60,000 acre-feet annually, has senior priority for any release. The Bureau of Reclamation determines on
8 an annual basis the quantity of water that is available for release to the two irrigation districts. The water
9 that is released is distributed on a ratio of 53% to the Elephant Butte Irrigation District and 47% to El
10 Paso County Water Improvement District.

11 At the time Elephant Butte Reservoir started storing water in 1916, it was the largest water
12 impoundment in the U.S. with an estimated capacity of 2.2 million acre-feet. As reported by the NMSU
13 Water Resources Research Institute, in 1988 the storage capacity was estimated at 2.065 million acre-feet
14 (WRRI 1996). The actual volume of stored water varies with climatological conditions and demand. In
15 recent history, the contents have varied from a low of less than 100,000 acre-feet in 1979 to maximum
16 capacity in 1987 and 1995. Since 1917, the average annual release from the reservoir has been
17 approximately 363,600 acre-feet. The average releases for the years with the minimum storage levels,
18 1978–1979, were approximately 200,000 acre-feet.

19 During 1990, it was estimated that about 165,000 acre-feet of water evaporated from surface water
20 bodies in Sierra County (Wilson 1992). This estimate includes both Elephant Butte and Caballo
21 Reservoirs, as well as other surface water areas, with the two reservoirs accounting for the greatest
22 amount of evaporation loss (WRRI 1996).

23 Water in Elephant Butte Reservoir is of good quality. The total dissolved solids average approximately
24 300 parts per million (WRRI 1996, Appendix F). This source of water for cryogenic production would
25 require only minimal pretreatment to ensure that the maximum total dissolved solids level of 300 parts
26 per million is not exceeded. The proposed action envisions the use of reverse osmosis filtration to
27 obtain cryogenic production quality water (“Water Supply” beginning on page 68). The return flow from
28 commercial RO treatment plants varies considerably with design. With a typical single-stage plant,
29 40–50% of the input water would be returned to the reservoir. Return flow at this level would constitute

1 approximately 800 acre-feet per year, or between 0.003%–0.004% of the total reservoir capacity. The
2 level of total dissolved solids in this return flow would be less than 500 parts per million, which would
3 not exceed Safe Drinking Water Act standards for potable water.

4 *3.2.1.2 Estimated 100-Year Floodplain*

5 According to the National Oceanic and Atmospheric Administration, the statistical 100-year storm
6 event for Truth or Consequences is 3.4 to 3.5 inches of rainfall for a 24-hour period, or 2.6 inches of
7 rainfall for a 6-hour period (NOAA 1973). The 100-year floodplain in the SRS area that would result
8 from this type of statistical storm event is shown in Figure 17.

9 The floodplain depicted in Figure 17 does not represent a floodplain in the traditional sense of the term.
10 Heavy rain on the packed desert floor runs off rapidly, and relatively evenly, outside of the long
11 established arroyo network. The floodplain within the SRS boundary, depicted on the Corps of
12 Engineers maps, represents areas where storm-water runoff exits from relatively narrow and deep
13 arroyos and spreads out over the ground under sheet flow conditions. Sheet flow occurs in areas where
14 the storm water runs off over the ground surface as a thin, even layer, not concentrated in a channel.

15 In those floodplain areas associated with the SRS, the storm-water runoff flows down gradients less
16 rapidly than from surrounding areas, exhibiting a tendency to form shallow pools in low-lying areas.
17 This drainage does not stand, or pond, in these low-lying areas for significant periods of time. Most
18 ephemeral water collected from heavy precipitation events will dissipate within two to four days. In the
19 arroyos, and in the area between Upham Hills and the Point of Rocks, storm-water runoff will collect
20 to a level of 2–18 inches and attain a significant horizontal velocity. These conditions will persist for only
21 a few hours.

Figure 17. 100-year Floodplain in the SRS Area

1 The drainage system that affects the central SRS area is a closed system. Flat Lake is the lowest point
2 of the proposed SRS area. As depicted in Figure 17, storm-water runoff from the Caballo Mountains
3 northwest and the San Andres Mountains east of the SRS drains into the floodplain flowing southward
4 along the Jornada Draw into Flat Lake. Storm water from the Caballo Mountains west of the SRS joins
5 runoff from the southwest side of the Point of Rocks to flow southwestward into the Rincon Arroyo
6 and ultimately into the Rio Grande. Drainage from the San Andres Mountains in extreme southeastern
7 part of the SRS flows into playas south of the SRS on the Jornada Experimental Range. Flat Lake and
8 excavated stock tanks retain storm-water runoff for longer periods of time than most other ephemeral
9 pools.

10 The existing county road infrastructure and internal ranch roads are not constructed to all-weather
11 standards and frequently are rendered impassable by storm-water runoff. Although ranchers attempt
12 to divert storm-water runoff away from those roadway areas especially susceptible to runoff damage,
13 there has been no intentional flood-control construction in the area.

14 **3.2.2 GROUNDWATER HYDROLOGY AND QUALITY**

15 Three aquifer systems underlie this region (King and Hawley 1975). The primary aquifer occurs in
16 unconsolidated alluvium and basin fill of Tertiary and Quaternary ages. The chemical quality of water
17 is poor (250 to 500 parts per million sulfates); water is rated nonpotable at greater than 500 parts per
18 million sulfates. Samples from a stock well on the east side of the site had total dissolved solids of 1,650
19 parts per million, and Stickel (1991) indicated that salt concentrations in the aquifer go much higher. A
20 second aquifer underlies the primary basin and is of Permian age. The chemical quality of that water is
21 nonpotable except at the northern edge of the basin, significantly beyond SRS boundaries. A third
22 aquifer occurs in the Cretaceous Age formation, but the amount of water is small and also of poor
23 quality (King and Hawley 1975). Generally nonpotable groundwater in the Basin is protected under
24 New Mexico regulations (Table 56, beginning on page 316). The Water Quality Control Commission
25 regulations protect groundwater sources that have a total dissolved solids level of 10,000 milligrams per
26 liter. An appropriate discharge plan would be filed with the New Mexico Environment Department as
27 required by 20 NMAC 6.2.III.3101 through 3114.

28 Recharge to aquifers in the Jornada del Muerto basin occurs in areas immediately adjacent to the major
29 mountain ranges. Precipitation in highland areas is absorbed by porous alluvium as runoff percolates

1 into the water table. Some aquifer recharge occurs from storm-water discharge through canyons and
2 arroyos. Recharge in the SRS area has been found to be 5% of the average 9 inches per year of rainfall
3 (King and Hawley 1975). Depth to groundwater in the vicinity of the SRS varies from 200 to 500 feet.
4 The aquifer thickness increases from north to south and from aquifer edge to the center. The estimated
5 thickness values used to model the Basin are from 300–600 feet on the northern boundary to 1,100 feet
6 on the southern boundary (WRRRI 1996).

7 Limited data for the central Jornada del Muerto basin shows that the groundwater flows into the basin
8 from the surrounding mountains and from the higher elevations north. Some northerly groundwater
9 movement is indicated from south of the SRS area near the San Andres Mountains. Near Point of
10 Rocks, the northerly and southerly fluxes merge and exit this section of the basin south via the Rincon
11 Arroyo into the Rio Grande (Cox and Reeder 1962). There is speculation that the basin also is
12 connected to the Rio Grande at Cutter Sag, but there is not sufficient evidence to warrant this
13 conclusion (WRRRI 1996).

14 Well records show that most wells in the SRS area produce from the Santa Fe Group (Subsection 3.1,
15 beginning on page 89) of the Quaternary fill. Transmissivity of this group ranges from 6,000 to
16 11,000 square feet per day. Lower transmissivities are encountered but appear to be localized. In the few
17 areas where storage coefficients have been calculated, the range appears to be from 10^{-2} to 10^{-4} . The
18 low storage coefficient is attributed to the clay layers found in the Santa Fe Group (Stickel 1991). For
19 the proposed water supply requirements, the local aquifer is capable of providing the necessary
20 quantities during the early years.

21 Several stock watering wells are on the project site. While they would be the most heavily impacted by
22 extraction of groundwater for the SRS, they are minor uses and could be supplied by SRS's wells if
23 necessary. The off-site wells that are nearest to the boundaries of the proposed SRS are the southern-
24 most well on the L7 Ranch—2 miles from the northern boundary—and NMSU's Agricultural
25 Experiment Station well—3 miles south of the southern boundary. The L7 Ranch well is reported to
26 be 410 feet deep with a static water level at 54 feet below the ground surface for a total water column
27 of 356 feet. The static water level of the NMSU well is approximately 100 feet below ground surface.
28 The depth of the well is unknown.

3.3 CLIMATE AND METEOROLOGY

Climatological and meteorological information is required in the analysis of the environmental effects of the proposed SRS in order to

- Plan and design certain aspects of the proposed facility such as orientation of the airfield, orientation of engine-blast diverters, and requirements for heating and cooling the buildings.
- Predict the dispersion of atmospheric pollutants that may be released by the proposed project and determine if quantities are sufficient to trigger regulatory requirements.
- Predict the quantity of fugitive dust expected during construction depending on soil moisture, precipitation, and wind conditions.
- Predict dispersion resulting from an accidental chemical release.

3.3.1 AVAILABLE DATA

Due to its remoteness, there are and have been no meteorological recording sites near the proposed location of the SRS. Data recorded at other meteorological stations in the region must be relied upon to obtain a general understanding of the meteorological environment. Meteorological stations close enough geographically and similar enough topographically to extrapolate climatological data for the proposed SRS location include Stallion Range Center on WSMR, Truth or Consequences, Hatch, and Jornada Experimental Range.

The Stallion meteorological station is operated to support testing activities on WSMR and is located approximately 70 miles northeast of the proposed SRS. The Truth or Consequences meteorological station is located at the municipal airport approximately 30 miles west-northwest of the proposed facility. The Hatch meteorological station is located at the municipal airport approximately 20 miles southwest of the proposed facility. The Jornada meteorological station is operated as part of a rangeland research project and is located approximately 30 miles south of the facility. Locations of these meteorological stations with respect to the SRS are shown in Figure 18. Because the meteorological stations are operated for different purposes, the parameters recorded vary from site to site. The length of time over which measurements have been made also varies but is at least five years in all cases.

3.3.2 CLIMATOLOGY FOR THE PROPOSED SRS

Table 10 contains a summary of the mean meteorological information for the four sites by month. Data indicate that the proposed SRS site has relatively mild winters with hot summers. The heaviest rainfall occurs in the summer months. Average annual rainfall is about 9 inches, with about half the total occurring during July and August. Most common wind directions are south and southwest, and the strongest winds occur in the late winter and spring. Data from the four stations were used to derive an estimated climatology for the proposed SRS. This information is presented in Table 11.

Lightning strikes are a common occurrence throughout New Mexico. In 1991, for example, the proposed SRS area was subjected to up to 13 lightning strikes per square mile (NWS 1996). At that rate, the 27 sections of land would be expected to receive up to 350 strikes per year.

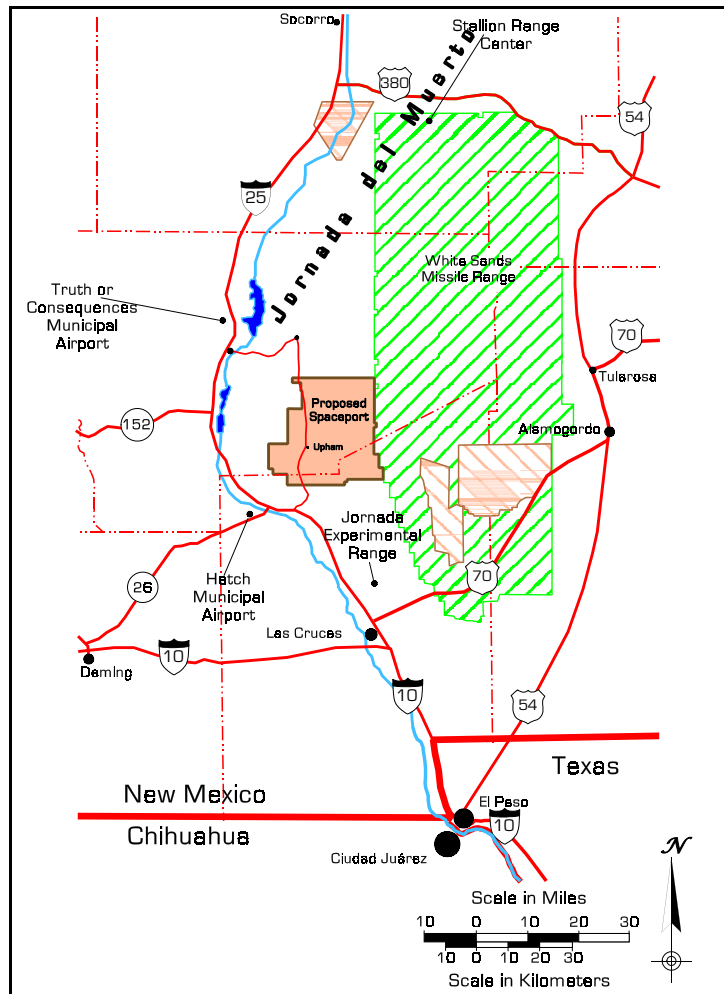


Figure 18. Locations of Stations Used to Assess Meteorological Condition at the Proposed SRS

Table 10. Month-by-Month Summary of Meteorological Information
at Recording Stations Closest to SRS

	Month	Mean Melted Precipitation (in)	Mean Temperature (F)	Mean High Temperature (F)	Mean Low Temperature (F)	Mean Daytime Wind Speed (mph)	Prevailing Daytime Wind Direction
1							
2	Stallion Range Center, WSMR						
3	January	0.12	34	49	19	6	N
4	February	0.17	39	54	24	7	N
5	March	0.25	47	62	31	8	SW
6	April	0.10	59	73	44	8	SW
7	May	0.25	66	83	49	8	SW
8	June	1.29	73	88	57	8	S
9	July	1.45	79	93	64	5	SE
10	August	2.09	76	90	61	5	N
11	September	1.26	68	82	54	5	SW
12	October	0.47	59	75	42	5	NE
13	November	0.25	49	65	32	7	N
14	December	0.53	37	50	23	5	NW
15	Annual	8.23	57	72	42	6	S
16	Truth or Consequences						
17	January	0.30	41	54	27	9	S
18	February	0.27	45	59	31	12	S
19	March	0.26	51	65	36	14	SW
20	April	0.22	59	74	44	15	SW
21	May	0.41	67	83	52	14	SW
22	June	0.78	77	92	62	12	SW
23	July	1.50	79	93	66	10	S
24	August	1.63	77	90	64	10	S
25	September	1.56	71	84	58	10	S
26	October	0.97	61	75	47	10	S
27	November	0.37	49	63	35	9	S
28	December	0.45	41	54	28	8	NE
29	Annual	8.77	60	74	46	11	S
30	Hatch						
31	January	0.49	41	58	23		
32	February	0.39	45	64	27		
33	March	0.25	51	70	33		
34	April	0.29	60	78	41		
35	May	0.27	67	86	48		
36	June	0.55	76	95	57		
37	July	1.84	79	95	63		
38	August	1.87	77	93	61		
39	September	1.48	71	88	54		
40	October	0.94	61	79	42		

Table 10. (Continued)

	Month	Mean Melted Precipitation (in)	Mean Temperature (F)	Mean High Temperature (F)	Mean Low Temperature (F)	Mean Daytime Wind Speed (mph)	Prevailing Daytime Wind Direction
1	November	0.35	49	68	30		
2	December	0.57	42	59	24		
3	Annual	9.33	60	78	42		
4	Jornada Experimental Range						
5	January	1.01	43	56	32	5	S
6	February	0.48	50	63	37	6	SW
7	March	0.24	56	69	40	7	S
8	April	0.13	64	78	45	7	S
9	May	0.99	72	86	55	6	S
10	June	0.56	82	96	64	7	S
11	July	1.96	84	97	70	6	SE
12	August	1.95	82	95	70	5	S
13	September	0.77	76	88	62	6	S
14	October	0.64	65	79	49	6	S
15	November	0.63	50	62	36	6	S
16	December	1.47	45	58	34	6	S
17	Annual	10.83	64	77	49	6	S

in — inches

F — Fahrenheit

mph — miles per hour

Data Sources:

Hatch and Truth or Consequences—*New Mexico Climate Manual: Solar and Weather Data*, Principal Investigators W. Scott Morris and Keith W. Haggard, New Mexico Energy Research and Development Institute, Santa Fe, NM, NMERDI 2-27-4523, November 1985.

Jornada Experimental Station—New Mexico Climate Center, New Mexico State University, World Wide Web address:

<http://weather.nmsu.edu>

Stallion Range Center—*White Sands Missile Range Climatology No. 5, Stallion Site, WSMR*, Paul H. Taft and Marjorie McLardie Hoidale, Atmospheric Sciences Office, White Sands Missile Range, New Mexico, DR-399, April, 1969.

The possibility of lightning must be considered in the design of the facilities and in developing maintenance procedures that require outdoor work. The rate of lightning strikes at the proposed SRS is approximately one-third the rate of strikes at Cape Canaveral, Florida.

Data collected at the Jornada Experimental Station were used to study the incidence of fog near the proposed SRS. These data indicate that the relative humidity in the area reaches 100%, the point at which fog or dew can form, only 0.08% of the time (NMSU 1996). It exceeds 90% only 4.2% of the time. Thus fog is a rare occurrence.

Table 11. Estimated Climatology for the Proposed SRS

	Month	Precipitation	Mean Temperature	Mean High	Mean Low	Daytime Wind Speed	Daytime Wind Direction
1							
2	Jan	0.40	40	54	25	7	S
3	Feb	0.32	45	60	30	8	SW
4	Mar	0.25	51	66	35	9	SW
5	Apr	0.19	60	76	44	10	SW
6	May	0.48	68	84	51	9	SW
7	Jun	0.80	77	93	60	9	S
8	Jul	1.69	80	94	66	7	SE
9	Aug	1.89	78	92	64	7	S
10	Sep	1.27	72	86	57	7	S
11	Oct	0.76	62	77	45	7	S
12	Nov	0.40	49	64	33	7	S
13	Dec	0.76	41	55	27	6	S
14	Annual	9.29	60	75	45	8	S

3.4 AIR QUALITY

The proposed SRS would be located in Sierra and Doña Ana counties, New Mexico, in Air Quality Control Region 153.

3.4.1 AIR QUALITY STANDARDS

New Mexico Ambient Air Quality Standards are set forth in Title 20, Chapter 3, Part 3 of the New Mexico Administrative Code. National Ambient Air Quality Standards are provided for in the Clean Air Act as amended (42 U.S.C. §7409) and established by the EPA (40 CFR Part 50). National primary standards “define levels of air quality that the (EPA) Administrator judges are necessary, with an adequate margin of safety, to protect the public health.” National secondary standards “define levels of air quality which the Administrator judges necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant” (40 CFR §50.2). National standards for time periods of 24 hours or less are satisfied when the level is exceeded no more than once per year. National standards for time periods greater than 24 hours are not to be exceeded. Federal and New Mexico standards for ambient air quality are shown in Table 12.

Table 12. National and New Mexico Standards for Ambient Air Quality

	National Primary Standard	National Secondary Standard	New Mexico Standard
1 Particulate matter PM ₁₀			
2 24-hour average	150 µg/m ³ ^a	150 µg/m ³	150 µg/m ³
3 Annual mean ^b	50 µg/m ³	50 µg/m ³	60 µg/m ³
4 Sulfur dioxide			
5 24-hour average	0.14 ppm ^c	—	0.10 ppm
6 Annual arithmetic mean	0.03 ppm	—	0.02 ppm
7 3-hour average	—	0.50 ppm	—
8 Carbon monoxide			
9 8-hour average	9.0 ppm	9.0 ppm	8.7 ppm
10 1-hour average	35.0 ppm	35.0 ppm	13.1 ppm
11 Ozone (1-hour average) ^d	0.12 ppm	0.12 ppm	0.06 ppm
12 Nitrogen dioxide			
13 24-hour average	—	—	0.10 ppm
14 Annual arithmetic mean	0.053 ppm	0.053 ppm	0.05 ppm
15 Lead			
16 3-month average	1.5 µg/m ³	1.5 µg/m ³	-e-

Notes:

a µg/m³ – micrograms per cubic meter

b The National annual standard specifies the arithmetic mean. The New Mexico annual standard specifies the geometric mean. The New Mexico standards are based on total suspended particulates.

c ppm – parts per million by volume

d For New Mexico, the term “photochemical oxidants” is used rather than “ozone.”

e New Mexico Air Quality Control Regulation No. 201 establishes a 30-day average concentration limit of 10 µg/m³ for particulate contaminants that contain any heavy metals.

Data Source: 40 CFR Part 50 and Title 20, Chapter 3, Part 3 of the New Mexico Administrative Code.

The Clean Air Act Amendments of 1990 include a provision in Section 176(c) that prohibits any Federal agency from supporting activities that do not conform to state implementation plans designed to attain national air quality standards. Agencies have an affirmative responsibility to achieve conformity. Agencies must conform to the purpose of a state implementation plan to eliminate or reduce the severity and number of National Ambient Air Quality Standards violations while achieving attainment of the standards. They also must ensure that activities will not cause any new violations of air quality standards, increase the frequency or severity of violations, nor delay timely attainment of standard or required emission reductions. EPA Air Conformity Regulations were issued on September 30, 1993, (58 FR 63214) and are contained in 40 CFR Parts 6, 51, and 93, effective January 31, 1994. Because the proposed SRS is in an area in attainment of national air quality standards for all criteria pollutants, a conformity determination is not required under EPA regulations.

3.4.2 AIR QUALITY STATUS AT THE PROPOSED SRS

The NMED concentrates its air quality monitoring efforts in geographical areas of the State that have the highest likelihood of not attaining ambient air quality standards for one or more criteria pollutants (“nonattainment” areas). There are few stationary emitters of air pollutants near the proposed SRS. The most important mobile and natural sources are

- motor vehicles (engine emissions and fugitive dust from unpaved roads)
- rail traffic (engine emissions)
- wind (natural particulates)

None of these sources could result in nonattainment of criteria pollutant standards at the proposed SRS. In the immediate proposed SRS area, estimates of current vehicular traffic on unpaved roads are as low as 20 vehicles per day. The AT&SF is approximately 5 miles west of the proposed SRS, and paved roads that carry major traffic (including I-25) are approximately 15 miles west. These sources produce highly dispersed pollutants. Wind normally causes the release of large quantities of particulates only from highly disturbed land surfaces such as agricultural fields and unpaved roads. The NMED has not found it necessary to operate a monitoring station near the proposed SRS. The closest station is in Las Cruces, approximately 40 miles south (NMED, pers. comm., 1996).

The proposed SRS is located in Air Quality Control Region 153. The area is in attainment of Federal and New Mexico Ambient Air Quality Standards. There are two Federal and New Mexico nonattainment areas within Air Quality Control Region 153 and another within adjacent Region 012 (40 CFR Part 81)

- The Anthony area, in southern Doña Ana County approximately 65 miles south of the proposed SRS, is in nonattainment of the PM₁₀ standard (respirable particulate matter). Nonattainment is thought to result primarily from heavy traffic on the extensive network of unpaved roads in the area.
- The Sunland Park area, in extreme southern Doña Ana County approximately 80 miles south of the proposed SRS, is in nonattainment for ozone. High ozone levels are thought to result from pollutant transport from the nearby El Paso, Texas/Ciudad Juárez, Chihuahua, international border area.

- A portion of Grant County, in Region 012 approximately 65 miles west of the proposed SRS, is in nonattainment for sulfur dioxide. This is the result of copper smelting operations at Hurley, New Mexico.

In light of all available information, it is concluded that the proposed SRS area is in attainment for all national and New Mexico air quality standards.

3.5 BIOLOGICAL RESOURCES

3.5.1 MAJOR BIOTIC COMMUNITIES AND HABITAT TYPES

3.5.1.1 Biotic Communities and Habitat Types—Biogeographic Perspective

From a biogeographic perspective, the proposed SRS site encompasses three major vegetation types. In order of dominance (Dick-Peddie 1993), these are semidesert grassland, plains-mesa sand scrub, and Chihuahuan desert scrub. In species composition, these three vegetation types correspond to the Chihuahuan desert scrub biotic community and the semidesert grassland biotic community (Brown 1982, Lomolino et al. 1989, Dick-Peddie 1993). Semidesert grassland dominates the southern and central portions of the proposed SRS site, Chihuahuan desert scrub vegetation lies along the western and eastern flank, and plains-mesa sand scrub separates semidesert grassland and Chihuahuan desert scrub vegetation in the central portion of the site.

Semidesert Grassland

The semidesert grassland biotic community is primarily a Chihuahuan desert grassland that surrounds low-elevation Chihuahuan desert scrub. At its lower boundary, grassland habitat merges with desert scrub, creating a complex landscape mosaic. Upper elevations of the grassland community contacts the Great Basin conifer woodland biotic community from approximately 4,600 to 4,900 feet in elevation. Grama grass, tobosa grass, fluff grass, bush muhly, burro grass, and alkali sacaton dropseed are the most diagnostic grasses within the site. Perennial bunch grasses are less common owing to extensive grazing by livestock. In areas with low precipitation, annuals are abundant. Trees, shrubs, succulents, and forbs include primarily honey mesquite, creosote bush, desert little leaf sumac, yucca, tarbush, ocotillo, long-leaf ephedra, broom snakeweed, Russian thistle, nightshade, and buffalo gourd.

Plains-Mesa Sand Scrub

Most of the proposed SRS area supporting plains-mesa sand scrub vegetation is contained within grassland vegetation. Much of these post-Pleistocene deep sands are dominated by plant species that are deep-sand tolerant, particularly within the central portion of the SRS area and along its southeastern border adjacent to the Jornada Experimental Range (Dick-Peddie 1993). Absence of sand-adapted plant species on mesquite dunes (coppice dunes) indicates recent origin of these dunes. In most situations, major plants associated with mesquite dunes are disturbance types, such as the half-shrub broom snakeweed and forbs such as tansy mustard and Russian thistle.

Major shrubs associated with plains-mesa sand scrub areas include fourwing salt bush, long-leaf ephedra, snake weed, mesquite, and little-leaf desert sumac. The most common forbs are annual buckwheat and sand verbenas. Major grasses include purple three-awn, bush muhly, and alkali sacaton.

Chihuahuan Desert Scrubland

Major vegetation in the Chihuahuan desert scrub community includes a combination of woody and herbaceous shrubs that are distributed between approximately 3,600 and 4,900 feet in elevation. Upper elevation boundaries are dynamic and ecotonal with the lower boundary of the semidesert grassland community. On the proposed SRS project site, Chihuahuan desert scrubland are composed of two primary desert scrubland vegetation types—Chihuahuan broadleaf evergreen desert scrub and Chihuahuan broadleaf deciduous desert scrub.

Chihuahuan Broadleaf Evergreen Desert Scrub (Creosote Bush)

Chihuahuan broadleaf evergreen desert scrubland are dominated by drought tolerant broadleaf evergreen shrubs. The major cover type is creosote bush. Common subdominant shrub associates are mariola, tarbush, purple prickly pear, cholla, and honey mesquite. Herbaceous cover is variable, ranging from sparse to grassy. Herbaceous species include buckwheat, desert verbenas, bahia, and desert holly. Characteristic species of grasses are fluff grass and black grama, although the proposed SRS contains little black grama. This habitat is distributed extensively throughout the SRS site. It primarily occurs along the western boundary of the site and in the west-central region of the site. Additionally, the northeastern one-third of the site is dominated largely by this vegetation community.

Chihuahuan Broadleaf Deciduous Desert Scrub (Mesquite)

Honey mesquite-dominated vegetation has been included in Chihuahuan desert scrub (Brown 1982) and in the plains-mesa sand scrub vegetation types (Dick-Peddie 1993). Mesquite-dominated Chihuahuan broadleaf desert scrub occurs extensively throughout the SRS area and the Jornada del Muerto. This scrubland is dominated by broadleaf deciduous shrubs that are cold and drought tolerant. Major shrub types are tarbush, honey mesquite, whitethorn, and ocotillo. Other common subdominant shrubs are fourwing saltbush, broom snakeweed, sotol, little-leaf sumac, tree cholla, and Christmas cactus. Herbaceous cover tends to be sparse or grass dominated. Common species of grass are fluff grass, mesa dropseed, alkali sacaton, and mallow.

The southeast corner of the proposed SRS site, from Flat Lake Ranch to the border of the site, is characterized by an extensive series of coppice dunes (deep sandy areas) formed by the accumulation of wind-blown sand around the base of mesquite shrubs forming hummocks. Species richness of plants is low. Most plant taxa associated with coppice dunes are “disturbance type” species (Dick-Peddie 1993), including the half-shrub broom snakeweed and forbs such as Russian thistle, desert marigold, hog potato, buffalo gourd, rattlesnake weed, peppergrass, tahoka daisy, desert holly, and scurfy sida, which are common in this area of the proposed SRS.

3.5.1.2 Biotic Communities and Habitat Types—Proximate Landscape Perspective

At a more proximate ecological or landscape level, eight major vegetation types are found within the boundaries of the proposed SRS site (Figure 19). Data are derived from the 100-hectare (247-acre) scale of resolution provided in the New Mexico Gap Analysis Project vegetation database.

- *Chihuahuan Broadleaf Deciduous Desert Scrub* (124,634 acres)

Figure 19. Vegetation Map of the Proposed SRS Project Area

- *Chihuahuan Foothill-Piedmont Desert Grassland* (31,458 acres)
- *Chihuahuan Broadleaf Deciduous Evergreen Desert Scrub* (89,094 acres)
- *Rock Outcrop* (1,053 acres)
- *Barren* (776 acres)
- *Short Grass Steppe* (6 acres)
- *Rocky Mountain Great Basin Open Conifer Woodland* (1 acre)

3.5.2 ENDANGERED, THREATENED, AND SENSITIVE SPECIES

The SRS property provides habitat for a wide variety of native species of plants and wildlife. These are discussed in the *Biological Assessment of the Proposed Southwest Regional Spaceport* (PSL 1996). From listings obtained from the USFWS, NMDGF, and New Mexico Energy, Mineral, and Natural Resources (NMEMNR), 20 species of plants and 50 species of animals of special interest potentially occur in Sierra and Doña Ana counties (Appendix D1). The proposed SRS lies within this area and encompasses approximately 387 square miles of natural habitat.

A species of special interest as used in discussions of biological resources in this document is defined as a species of plant or animal that is listed as an Endangered, Threatened, Proposed, or Candidate Species; Species of Concern; Rare and Sensitive Species; Sensitive; Rare; or Protected Species under one of the following statutes:

- Federal Endangered Species Act (16 U.S.C. §1531 et seq.)
- New Mexico Endangered Plant Species Act (NMSA §§9-0-5 and 9-10-10)
- New Mexico Wildlife Conservation Act (NMSA §17-2-41)
- Migratory Bird Treaty Act (16 U.S.C. §§703-712)
- Bald and Golden Eagle Protection Act (16 U.S.C. §§668-668d)

The definition of species of special interest used in this document is more encompassing than the new USFWS designation of “Species of Concern.” Legal designations for these categories are described in Table 13. Included in the list are those species that may be affected by direct, indirect, or cumulative impacts caused by the proposed action whether or not they are

Table 13. Federal and State Species Designations

	Classification	Description
1		
2	Federal (U.S. Fish and Wildlife Service)	
3	Endangered (E) species	A species in danger of extinction throughout all or a significant portion of its range
4	Threatened (T) species	A species likely to become endangered within the foreseeable future throughout all or a significant portion of its range
5	Proposed species	Those species that have been formally submitted to Congress for official listing as endangered or threatened
6	Candidate	Species for which the USFWS has on file sufficient information to support issuance of a proposed rule to list under the Act. These taxa are not known or believed to be extinct; not subject to taxonomic review and the USFWS contains sufficient information on status and threats to justify proposed rule.
7	Species of Concern	Species for which the USFWS does not have sufficient information available to support their being listed as endangered or threatened at this time
8	State of New Mexico – Plants (New Mexico Forestry and Resource Conservation Division)	
9	L1 (Endangered)	A species that is in danger of becoming extinct or is in danger of extirpation from the State of New Mexico
10	L2 (Rare and sensitive)	A species that is considered to be rare because of restricted distribution or low numerical density throughout their range
11	L3 (Rare)	A species that lacks sufficient information to either list or reject
12	L4 (Considered but not included)	A species that was included on the 1985 New Mexico Heritage Program Element List, but that was not included on Lists 1, 2, or 3. It also contains species that were previously listed, but subsequently rejected in interagency reviews. It includes taxa originally listed as L2 or L3 but since 1992 were determined to be too abundant to retain.
13	State of New Mexico – Animals (New Mexico Department of Game and Fish)	
14	E1 (Endangered Group 1)	A species whose prospect of survival within the State is in jeopardy
15	E2 (Endangered Group 2)	A species whose prospect of survival is likely to become jeopardized in the near future
16	S (Sensitive)	A species that has been singled out for special consideration (i.e., State's equivalent of "candidate").

- 17 Data Source:
- 18 1. Endangered Species Act of 1973, Section 3, and 50 CFR Part 402.
- 19 2. Sivinski and Lightfoot 1995.

20 protected by Federal or State regulations. The broadened consideration of species in this document is

21 intended to give maximum attention to biodiversity issues. Present management for Federal or State of

22 New Mexico Endangered, Threatened, or Proposed species consists of protecting and enhancing

habitat. The proposed action and alternatives for the SRS were evaluated for their potential impact on known populations of, or potential habitat for, listed or candidate species.

Of the 70 potentially occurring species of special interest, biological surveys conducted from 1994 to 1996 observed 2 of the 20 species of plants and 15 of the 50 species of animals in the proposed SRS area (Appendix D1). Of the animal species, Bell's Vireo is classified as Threatened by the State of New Mexico; the Ferruginous Hawk is classified as a Federal Candidate species; and three species—Western Burrowing Owl, Loggerhead Shrike, and Texas horned lizard—are classified as USFWS Species of Concern. None of the remaining species have a Federal or State classification. No other endangered or threatened species of plants or animals were observed. The remaining 50 (76%) of the species of special interest were not observed on the SRS site because of lack of suitable habitat or because the SRS area is not in their known geographic range. Copies of correspondence containing the USFWS, NMDGF, NMEMNR lists are contained in Appendix B.

3.5.2.1 Flora

One-hundred forty (140) species of plants were found on or in the vicinity of the proposed SRS site (Appendix D2). No species of special interest were found in areas potentially affected by construction of the proposed SRS facilities. When biological field surveys were initiated in August 1994, Scheer's pincushion cactus (*Coryphantha scheeri* var. *valida*) and Wright's pincushion cactus (*Mammillaria wrightii* var. *wrightii*) were listed as State endangered species. However, in October 1995 these two cacti were down-listed from List 1—*State Endangered Species List* to List 4—*Plant Taxa Considered, But Not Included List*. The 1995 New Mexico down-listing occurred because the species are now considered “too common” in New Mexico to justify retention on List 1 (Sivinski and Lightfoot 1995). Thus, these species of cacti currently are not protected, and it is not required that these species be avoided during construction of SRS facilities. In addition, two other List 4 plant species—Kuenzler Hedgehog Cactus (*Echinocereus fendleri* var. *kuenzleri*) and Button Cactus (*Epithelantha micromeris*)—were found in the proposed SRS area.

3.5.2.2 Fauna

One hundred fifteen (115) species of animals were found on or in the vicinity of the proposed SRS site (Appendix D3), including 19 species of mammals, 70 species of birds, 18 species of reptiles, and 8

species of amphibians. This list also includes several of the larger species of ungulates—mule deer, oryx, and pronghorn.

Fifteen animal species of special interest were found on the proposed SRS site. These taxa included small- to large-sized raptorial bird species and two species of horned lizards. Species included the Western Burrowing Owl (USFWS Species of Concern), Ferruginous Hawk (Federal Candidate), Loggerhead Shrike (USFWS Species of Concern), Bell's Vireo (State Threatened), Texas horned lizard (USFWS Species of Concern). In addition, several other Federal and State of New Mexico protected species were observed. These include Cooper's Hawk, Golden Eagle, Long-eared Owl, Great Horned Owl, Swainson's Hawk, Northern Harrier, Prairie Falcon, American Kestrel, Harris's Hawk, and the Short-horned lizard (Appendix D1).

Northern Aplomado Falcon

The Northern Aplomado Falcon is a Federal endangered and State of New Mexico endangered (Group 1) species. Despite extensive biological field surveys of raptors and potential nesting habitat over a 2-year period, this species was not observed in the immediate vicinity of the proposed SRS area. Historically, the Northern Aplomado Falcon was widespread and common in deserts of the southern quarter of New Mexico during late 19th and early 20th centuries (Hector 1987, NMDGF 1991) and has been documented in a variety of open woodland, savanna, and grassland habitats (Hector 1981, USFWS 1990). Home range estimates for this species vary from approximately 1 to 8 square miles. Range of juvenile dispersal is uncertain but may be as far as 85 miles. Preferred habitat generally occurs below 6,500 feet in scattered mesquite and yuccas (Ligon 1981, Montoya and Zwank 1995, USFWS 1996a). Within the proposed SRS site, this kind of habitat is most common along the floodplain north of Prisor Hill, along the base of the western slope of Prisor Hill and Upham Hills associated floodplain and along the north-facing slope of Point of Rocks.

There have been four confirmed sightings of the Northern Aplomado Falcon in the very general vicinity of the proposed SRS. The northernmost historical range for this species was approximately 65 miles north of Engle, New Mexico, and 115 miles north of Alamogordo (Hector 1987). Confirmed observations were made in May and June 1991 and April 1992 on WSMR. Another confirmed sighting was made in July 1992 between Carrizozo and San Antonio, New Mexico. The latest confirmed sightings were made of a single bird from July 19 to July 25, 1996. These sightings were at Isaack Lake,

1 a playa 10 miles north-northeast of Las Cruces and 35 miles southeast of the SRS area. A confirming
2 photograph of this bird showed it to be a “bird of the year,” that is a bird that hatched and fledged this
3 year, and not part of a nesting pair (NMDGF, pers. comm., 1996). These confirmed sightings have
4 heightened interest in this species. The WSMR Environmental Services Division is currently considering
5 designation of several areas on WSMR as special management areas that would be treated as “critical
6 habitat” set-asides for the Northern Aplomado Falcon (WSMR Environmental Services Division, pers.
7 comm., 1996).

8 **3.5.3 BIOLOGICAL DIVERSITY AND SENSITIVE SPECIES HABITATS**

9 Habitat may be considered sensitive because of

- 10 • its designation as critical habitat for listed species
- 11 • its loss or disturbance would result in the “taking” of a species listed as endangered or
12 threatened by the State of New Mexico or the USFWS
- 13 • legal considerations—including permit requirements for dredging and filling of wetlands and
14 waters of the United States
- 15 • its unique characteristic of geographic area
- 16 • its being ecologically critical area

17 Habitats important for biodiversity that occur within the boundaries of the proposed SRS site are
18 discussed in the following sections. There are no defined sensitive or critical habitats present within the
19 SRS construction areas.

20 **3.5.3.1 Wetlands**

21 Waters of the U.S. are defined as those that are currently, or historically, susceptible to use by interstate
22 or foreign commerce. Waters of the United States are under the jurisdiction of the U.S. Army Corps of
23 Engineers. As defined in 33 CFR §328.3, “Waters of the U.S.” include “. . . intrastate lakes, rivers,
24 streams (including intermittent streams), mudflats, sand flats, wetlands, sloughs, prairie potholes, wet
25 meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which would effect
26 interstate or foreign commerce including any such waters that are used or could be used for industrial
27 purposes by industries in interstate commerce.”

28 No jurisdictional wetlands were found at the proposed SRS site. Although the SRS site is considered
29 a “nonwetland” site, a large ephemeral floodplain extends from north-to-south through the west-central

1 portion. This area has saturated soils only for brief periods of the growing season and supports a
2 prevalence of vegetation typically adapted for life in aerobic soils.

3 Occasional heavy rains during summer monsoons create isolated ephemeral free water sources within
4 these large drainage basins. These seasonally ephemeral water sources provide critical water for local
5 vegetation and wildlife, including such species as the spadefoot toad that burrows into the soil and
6 passes most of the year in a hibernation-like state. After drenching monsoonal rains, the spadefoot toads
7 emerge in large numbers and engage in vociferous courtship displays and lay eggs in the largest
8 temporary pools.

9 Although several man-made earthen stock tanks are distributed throughout the SRS site, these sites
10 largely are devoid of vegetation because of concentrated use by livestock. Although these earthen tanks
11 contain water only after locally heavy rains, they also may provided breeding habitat for amphibians,
12 including both spadefoot toads and the tiger salamander.

13 *3.5.3.2 Riparian and Arroyo Vegetation*

14 Riparian areas are defined as land directly influenced by permanent water (Elmore and Beschta 1987,
15 BLM 1992). These areas have visible vegetation or physical characteristics associated with permanent
16 water influence. Spring areas and stream banks are typical riparian habitats. Ephemeral streams or
17 washes are excluded if they do not exhibit the presence of vegetation dependent upon free water in the
18 soil (BLM 1992). There are no riparian areas present within the proposed SRS area.

19 Arroyo habitats associated with the many dry washes throughout the proposed SRS site are not
20 considered riparian areas by definition (BLM 1992). However, because of their diverse vegetation that
21 often occurs in stark contrast to surrounding desert scrub and grassland habitats, they are considered
22 important areas that may require special management attention.

23 At higher elevations on the proposed SRS project site (e.g., Prisor Hill, Upham Hills, Point of Rocks),
24 arroyo-like vegetation is sparse and appears primarily to be associated with small drainages and canyons.
25 Some arroyo habitat is present in Fleck Draw and several other unnamed arroyos in the southeastern
26 quarter of the southern SRS area. Both types of vegetation constitute less than 1% of the area of the
27 proposed SRS. None of this habitat is present in any of the proposed facility construction areas.

3.5.3.3 *Migratory and Protected Bird Species*

The Jornada del Muerto has a high degree of biological diversity in comparison to other areas of the U.S./Mexico Chihuahuan Desert with similar elevation, climate, topography, and water resources. This diversity is due to the large numbers of birds present in the Rio Grande flyway, which is 15 to 25 miles west of the proposed SRS. This is the major flyway in the area and is used seasonally by neotropical migratory birds en route between the northern and southern parts of the hemisphere. It follows the Rio Grande and generally extends only a few miles either side of the river's riparian area.

Bird species constitute the majority of the wildlife observed during the biological surveys of the SRS (Appendix D). A total of 115 animal species were observed. Of these, 70 species were birds, 19 were mammals, 18 were reptiles, and 8 were amphibian. The bird species observed were raptors, migratory passerines, neotropical migratory birds, and game birds. Although none of the observed species is a Federal or State-listed Endangered, Threatened, or Proposed species, most of them are protected under the provisions of the Migratory Bird Treaty Act and New Mexico statutes. Specific bird surveys determined that the average density of bird species (number of birds per square kilometer) varied from 18.1 in the southern portion of the area, to 9.8 in the floodplain area of the airfield, to 1.2 in the remaining portions of the SRS.

Surveys specifically for the presence or absence of raptor species including the Aplomado Falcon were conducted in the proposed SRS area from the fall of 1994 through the spring of 1996. Since all raptors have protected status under New Mexico statutes, the survey crews recorded all observations of raptor species. The data collected during these observations included the complete ecological cataloging for 95 individual stick nests.

The surveys located 179 stick nests associated with various proposed construction sites (Figure 20). Ninety-five (95) of these nests were monitored from the spring of 1995 through the spring of 1996. Forty-one (41) of the nests were located within the 27 sections of land that would be reserved for exclusive use or within 400 meters of the main access road.

Geographic Information System/Landscape Level Resolution

Based on Geographic Information System (GIS) analysis of the New Mexico Gap Analysis Project vegetational database, stick nests predominantly are found in Chihuahuan Broadleaf Evergreen (44.1%)

1 and Chihuahuan Broadleaf Deciduous desert scrub (41.8%) plant communities, followed by Chihuahuan
2 Foothill-Piedmont Desert Grassland (13.4%) and rocky outcrop (0.8%) habitats. Topographically, most
3 nests occur within a distinct drainage/arroyo (24.0%) or within the broadly delineated boundaries of
4 the 100-year floodplain (22.9%), as mapped by the U.S. Army Corps of Engineers. Sixteen percent
5 (16%) of the nests are adjacent to existing dirt roadways, and 2.2% of the nests are along the existing
6 high-voltage power lines. The remaining nests (34.6%) are within major tracts of desert scrub.

Figure 20. Raptor Nest Areas

Proximate/Ecological Level of Resolution

Site-specific ecological data were collected for 95 stick nests. Most of these nests (91%) were in good structural condition. Average elevation of habitat where nest trees were found was 4,249 feet. Predominant topography associated with nest trees included swales (39.1%) and silty flats (29.9%), followed by playa-like habitat (18.4%), arroyos (6.3%), and bajadas (5.7%). Primary macrohabitat included Chihuahuan desert scrub (80.7%) followed by desert grassland (19.3%). Nest trees generally were located in sandy/clay (88.5%), caliche (8.0%), and desert pavement soils (3.4%). The primary species of nest trees were honey mesquite (61.0%), desert sumac (35.0%), yucca (6.9%), and desert willow (1.2%); 1.2% of nests were on power poles. The average height of a nest tree was 13.5 feet and the average height of the nest above the ground was 9.2 feet.

Use of Raptor Nests

During the early Spring of 1995 (April through June), 95 of these stick nests were monitored throughout the proposed SRS site. Seventy (70) (74%) of these nests were unoccupied, whereas 25 (26%) occupied nests were attended by 45 Chihuahuan Ravens, one by Swainson's Hawks, and one by Red-tailed Hawks. During the following spring raptor survey from April through June 1996, the same 95 stick nests were monitored throughout the proposed SRS site. Sixty-nine (69) (73%) of the nests were unoccupied, and the 26 (27%) occupied nests were attended by 20 Ravens, 10 Swainson's Hawks, 2 Red-tailed Hawks, and 4 Great Horned Owls. Lack of nesting may be related to the current extreme drought conditions found in the Southwest. Because of the generally small size of both nest trees (less than 18 feet) and stick nests (less than 22 inches across), as well as the arboreal location and nonreinforced structural composition of the nests, it is unlikely that any of these nests were ever used by large-sized raptors such as the Golden Eagle.

3.5.3.4 Wildlife

The high biological diversity of wildlife in southern New Mexico is the result of several biotic and abiotic factors, including variability in elevation, topography (land forms), climate (e.g., precipitation, temperature), vegetation communities, and a diverse biogeographic history involving colonization and evolution of unique (endemic) species and subspecies of plants and animals (Findley et al. 1974, Brown 1982, Dick-Peddie 1993, PSL 1995).

Big Game Species

Four species of big game occur within the boundaries of the proposed SRS site. These species include mule deer, pronghorn, mountain lion, and African oryx, which are increasing in the proposed SRS area. Inhabiting the upper reaches of the San Andres Mountains on WSMR along the eastern boundary of the SRS is the desert bighorn, a State of New Mexico Endangered Species (E1). However, there is no bighorn sheep habitat within the proposed SRS. This species occurs as lone individuals or in scattered small bands. The population of desert bighorn sheep in the San Andres Mountains primarily occupies areas above approximately 6,000 feet with an average slope of 62%. The only seasonal change in locations inhabited by sheep bands is movement of some rams out of established herding areas following the end of the rutting season during winter months (Sandoval 1979). Ewes continue to inhabit the same general herd areas during lambing, although there apparently is some habitat selection by ewes for cliff-associated sites with more eastern exposures (Sandoval 1979). Individual sheep often descend to lower elevations for short periods of time to access water at canyon springs; they seldom venture more than 1.5 miles from water (Sandoval 1979).

3.6 CULTURAL RESOURCES

Archaeological sites in south-central New Mexico embody a long occupational sequence beginning with the Paleoindian of 11,500 years ago and continuing through 400 years of historic use (post-1540) (Kirkpatrick et al. 1992). The cultural resource history of the Jornada del Muerto basin and the Rio Grande valley near the proposed SRS includes the following four major cultural and temporal periods—Paleoindian, Archaic, Formative, and Historic. A summary of these periods and the findings of surveys in the SRS region are discussed in the following subsections.

3.6.1 PALEOINDIAN

The now-dry Jornada del Muerto basin was once a lush woodland/grassland environment with the major, internally drained draws providing a focus for the hunting activities of the Paleoindians during the Pleistocene epoch. The number of Paleoindian sites located during the SRS survey is high, compared to the few recorded sites in the Jornada del Muerto. The earliest Paleoindian hunters subsisted on the now-extinct mammoth that congregated around Pleistocene lake beds throughout southern New Mexico. Most artifacts found in the proposed SRS area were isolated projectile points and hearths, although ash stains, artifact scatters, and rock art in the form of petroglyphs also have been recorded. Sites are rare, probably because of small population densities and extensive erosion and deposition.

1 What is known of the Paleoindian period dates from 11,500 to 7,500 years ago and is based in part on
2 extensive work from other parts of southern New Mexico near the Jornada del Muerto basin.

3 **3.6.2 ARCHAIC**

4 Early to late Archaic period sites (6000 B.C. to A.D. 200) are located in a variety of environmental and
5 topographical areas within the Jornada del Muerto, but appear to be centered along or near major arroyo
6 systems and playas (Ackerly 1992). The variety and number of spear points suggests a continued
7 dependence on large game, and the ground-stone industry continued to increase. In addition, during the
8 Archaic Period, there was a long, stable period of changing food collection practices from
9 hunter/gatherers to agriculturalists that supplemented natural resources with cultivated resources to
10 provide a more reliable food source. Early tools have been found for plant cooking in pits and seed
11 grinding, as well as tools for hunting and skin processing. Domesticated corn seeds probably were
12 imported to the area and grown in a climate that was less arid than today. Corn likely was collected as
13 it ripened and used as much as any other wild food. During the Hueco phase (900 B.C. to A.D. 200),
14 other new races of corn were introduced, in addition to beans and perhaps amaranth.

15 **3.6.3 FORMATIVE**

16 The Formative period in south-central New Mexico, called the Jornada Mogollon (Lehmer 1948),
17 encompasses the Mesilla, Doña Ana, and El Paso phases dating from A.D. 400 to 1400. The Formative
18 period is marked by increased reliance on agriculture, increased population concentration through time,
19 and increased communication among culture areas. Large-scale camps and habitation sites of large
20 pithouse-period villages (Lekson and Rorex 1987, Sale and Laumbach 1989) along major west-draining
21 arroyos of the San Andres Mountains indicate an intensive occupation within an area just east of the
22 proposed SRS. Potentially arable soil within and surrounding the arroyos, as well as other abundant
23 resources, appears to have been an important factor in the settlement along arroyos. El Paso
24 Polychrome jars with everted rims indicate changes in the function of vessels through time from
25 gathering to cooking and then to storage (Seaman and Mills 1988).

26 **3.6.4 HISTORIC PERIOD**

27 During Historic times (post-1540), only a small number of identifiable, Apache-related materials and
28 sites have been recorded in the area. These consist of hearths, a mescal pit/stone circle, and petroglyphs.

1 Only one Apache site has been recorded at Point of Rocks near the proposed SRS. Previously recorded
2 historic sites have been attributed to Hispanic and Anglo or Euro-American cultures. Hispanic sites
3 consist of hunting hearths and a road/trail. Anglo sites are relatively numerous and variable. These sites
4 have features that include wells, cairns, ash stain, corrals, tanks, windmills, barns, house and outbuilding
5 foundations, a mine shaft/tunnel, dumps, and roads.

6 *3.6.4.1 The Elusive Apache*

7 The Apache—Athabascans who migrated from Canada, possibly by way of the eastern slopes of the
8 Rocky Mountains—probably entered the Southwest about A.D. 1500 (Opler 1983, Willey 1966:233).
9 By A.D. 1600, they employed a hunting and gathering subsistence strategy to exploit large areas with
10 varied resources for scheduled, seasonal harvesting (Lekson 1985:147). Earliest reports of the Apache
11 in south-central New Mexico were provided by Spanish explorers who were following the Rio Grande
12 Valley to northern New Mexico. Apache raiding proved more limiting to the settlement of the New
13 Mexico territory than lack of water. Travelers along El Camino Real de Tierra Adentro (The Royal Road
14 of the Interior Lands [El Camino Real]) from Ciudad Chihuahua, Chihuahua, Mexico, through the
15 Jornada del Muerto to Santa Fe, New Mexico, suffered continual attacks by the Apache (Figure 21).

Figure 21. El Camino Real

3.6.4.2 *Period of European Influence*

The first Europeans to see south-central New Mexico were the Spanish explorers—Francisco Sanchez Chamuscado (1581–1582), Antonio de Espejo (1582–1583), and Francisco Leyva de Bonilla (1593). They helped explore the route between Ciudad Chihuahua, Chihuahua, Mexico, and Santa Fe, New Mexico, (Williams 1986) on El Camino Real. The trail served as a leading route between frontier Santa Fe and Mexico City for 200 years. The route of El Camino Real lies adjacent to the proposed SRS (Palmer et al. 1993). The route in southern New Mexico follows the Rio Grande except near the Caballo Mountains where the trail leaves the river because of rough terrain and enters the most dangerous part of the Camino Real, the Jornada del Muerto basin. The route travels for about 90 miles through the basin before rejoining the Rio Grande. This essentially waterless portion of the trail is the reason the basin acquired the Spanish name of the Jornada del Muerto or “the Journey of the Dead Man” (Preston 1994). There are fourteen sites within the SRS boundary area that contain evidence of the Camino Real. Archaeological remains include evidence of the trail consisting of campsites, ramps, and other improvements to cross environmental barriers, such as arroyos and ridges.

Aleman, located along the Camino Real and now a ranch, began as the first permanent water source along the trail. As wells were drilled in the Jornada del Muerto, ranching became more important to the region. Although ranching is a mainstay in Sierra County, ranches in the Jornada del Muerto are still affected by limited rainfall and a desertification of rangeland. After construction of the AT&SF in 1881, stations such as Engle and Upham—now abandoned as railroad stations—were used for servicing locomotives and for shipping cattle to the beef markets of the Midwest. In 1916, Elephant Butte Dam was built across the Rio Grande to harness the river for irrigation. The dam formed Elephant Butte Reservoir, approximately 25 miles northwest of the proposed SRS.

3.6.5 **ARCHAEOLOGICAL FINDINGS**

El Camino Real, three Apache study areas, and sites showing evidence of early ranching activities are potentially eligible for nomination to the National Register of Historic Places. Their eligibility would fall under Eligibility Criteria (a)—*Affiliation with an Important Event* and (d)—*Research Potential* as established by fieldwork conducted by Marshall (1988, 1991). There are two study areas in the vicinity of the Point of Rocks that contain four archaeological sites. There is another study area near the Rincon Arroyo (Marshall 1991:24–32) that contains two archaeological sites.

3.6.5.1 *Archaeological Records Search*

The Class I archaeological survey (a records search) was conducted and a total of 749 records of archaeological sites previously recorded in the general area of the proposed SRS were found. This included 33 sites (Kirkpatrick and Hart 1995) documented during an earlier survey for the SRS as shown in Table 14. All of these sites are classified as potentially eligible for listing and are protected by the National Historic Preservation Act.

This survey was conducted of the Archaeological Records Management System computerized database in Santa Fe, New Mexico, and included an examination at the BLM Las Cruces District Office of 30 U.S. Geological Survey topographic quadrangle maps that cover the area of the proposed SRS. A records search also revealed that no sites currently listed in the 1996 National Register of Historic Places and the New Mexico Register of Cultural Properties are situated within the proposed SRS site.

An archaeological site is defined as multi-component when two or more cultures or time periods can be identified from the artifacts or features. In the SRS area, the majority of multi-component site types are prehistoric, resulting from Archaic and Mogollon cultures. These sites included artifacts such as hearths, isolated rooms, middens, mounds, and rock art in the form of pictographs. The only historic multi-component site is a road attributed to both the Hispanic and Anglo cultures. A large number of previously recorded sites in the area fall into the Unknown category. These sites could not be assigned a cultural or temporal classification because recording archaeologists could not find diagnostic artifacts or features used to identify a cultural or temporal affiliation. These sites include mostly lithic-artifact scatters, hearths, a rock shelter, a shrine, a quarry, rock art, and an extant house.

Table 14. Previously Recorded Sites in Area of the SRS

	Culture of Site Components	No. of Sites
1		
2	Single-Component Sites	
3	Paleoindian	3
4	Archaic	74
5	Mogollon	224
6	Unknown	218
7	Apache	1
8	Hispanic	10
9	Euro-American	38
10	Two-Component Sites	
11	Paleoindian/Mogollon	1
12	Archaic/Mogollon	58
13	Archaic/Historic Pueblo	1
14	Archaic/Euro-American	6
15	Archaic/Unknown	2
16	Mogollon/Apache	1
17	Mogollon/Mogollon	24
18	Mogollon/Euro-American	3
19	Mogollon/Unknown	19
20	Hispanic/Euro-American	9
21	Euro-American/Euro-American	1
22	Euro-American/Unknown	3
23	Unknown/Unknown	2
24	Three-Component Sites	
25	Paleoindian/Archaic/Archaic	1
26	Paleoindian/Archaic/Mogollon	2
27	Archaic/Archaic/Mogollon	1
28	Archaic/Archaic/Unknown	1
29	Archaic/Mogollon/Mogollon	19
30	Archaic/Mogollon/Euro-American	5
31	Archaic/Apache/Euro-American	1
32	Archaic/Mogollon/Apache	3
33	Mogollon/Mogollon/Mogollon	15
34	Mogollon/Mogollon/Apache	1
35	Mogollon/Mogollon/Unknown	2
36	Total	749

3.6.5.2 Cultural Resources Survey

A Class III survey (a field survey) also was conducted during 1995 and 1996 covering 4,027 acres encompassing the area affected by the proposed construction of the SRS facilities. The survey encompassed the direct footprint of proposed construction activities and an approximate 75-foot buffer zone around the area of disturbance. In the RLV operations and airfield areas, the survey was a total block survey with a quarter-section buffer around any projected construction.

3.6.6 EL CAMINO REAL NATIONAL HISTORIC TRAIL DESIGNATION

The National Park Service has determined that El Camino Real is eligible to be designated a National Trail. The U.S. Congress is expected to receive the final Park Service study with this finding in 1997.

3.6.7 CULTURAL RESOURCES INVENTORY

SRS Site Characteristics, found in Appendix E, show the 125 cultural resource sites found during the Class III surveys. Some of these sites could be subjected to disruption by the proposed actions of the SRS. For example, the first group of sites is found along the proposed route of the main access road. Appendix E identifies by site the following characteristics:

- the identity of cultural groups and the historical time-period associated with their occupancy
- a summary of the artifacts and other archaeological features
- an estimate of the size of the area
- the key points that would be used to evaluate a site's eligibility for the National Register of Historic Places
- land ownership
- type of mitigation action that is proposed if the site would be affected by construction activities

The inventory of sites found by the Class III survey is summarized in Table 15 by historic period, survey location, number of sites by archaeological component, and acreage.

Table 15. Site and Component Counts for Space Report Survey Area

		Urd.	Aleman	Block	SSTO	Runway	Regulatory Standards and Noise Thresholds	Apron	Pipeline	Access-SCCF	Access-Launch 2	Total
1	Total Sites	10	14	5	50	20	7	7	4*	1	2	125
2	Acres	163.1	85.7	1108.3	1431.8	550.9	206.6	189.4	70.6#	137.7	24.1	4174.8
3	Paleoindian	0	0	0	13	0	0	1	1	0	0	15
4	Archaic	4	1	1	7	1	1	2	1	0	1	24
5	Formative	3	2	0	12	7	7	0	1	1	1	39
6	Unknown	4	6	1	29	13	0	3	3	0	0	59
7	Historic	4	2	3	1	0	0	0	0	0	0	10
8	Camino Real	0	13	2	0	0	0	0	0	0	0	15
9	Total Components	15	24	7	62	21	8	11	6	1	2	162

10 * Survey incomplete pending access to AT&SF and Cain Ranch at Aleman
 11 # Includes private land near Aleman

3.7 NOISE

The proposed SRS would be located in an area that has few major noise sources. Figure 22 provides a graphical comparison of common noise environments and sources.

3.7.1 NOISE TERMINOLOGY AND EFFECTS

Sound levels customarily are measured in decibels (dB). Each 10 dB increment represents a factor of 10 in energy. Thus, a sound wave of 80 dB intensity carries ten times as much energy as a sound wave of 70 dB, but it seems only twice as loud. The dB scale is logarithmic because the response of the human ear to sound intensity is logarithmic.

Figure 22. Typical Sound Levels from Indoor and Outdoor Noise Sources and Their Effects on People and Structures
 Data Source: DA (1978), Harris (1991), Miller (1980), NASA (1996b),

The human ear generally is considered to be sensitive to sounds within the frequency range from 20 Hertz (Hz [vibrations per second]) to 20,000 Hz, although it is not equally sensitive to all frequencies. For example, a sound frequency of 4,000 Hz with a given intensity is perceived to be much louder than a 100-Hz sound with the same intensity. A 100-Hz sound is approximately equivalent to the musical note one octave below low C. A 4,000-Hz sound corresponds approximately to the musical note three octaves above high C. Weighting scales have been developed to approximate the response of the human ear. The A-weighting scale is the most commonly used. It was designed to correct for the auditory sensitivity of the human ear to low-to-moderate intensity sounds. The C-weighting scale approximates the response of the human ear to high intensity sounds (NIOSH 1973). Sound levels measured with A- and C-weighting are abbreviated dBA and dBC.

Impulse noise results from sources such as explosions and sonic booms. It is of very brief duration, typically a fraction of a second. Measurements of impulsive sounds must be made with a special

1 “impulse” setting on a noise meter. Such measurements are useful in comparing the perceived loudness
2 of different impulse sounds, but they cannot be used directly for comparison with average noise level
3 measurements of steady sources. For example, a steady 90-dB noise level would render conversation
4 difficult. A single 90-dB impulse sound would have minimal effect on conversation because it would
5 be of short duration. However, it would be noticed readily and probably would cause a startle reaction
6 or disturb sleep. For impulsive sounds, low-frequency, inaudible components also are important. The
7 apparent loudness often is less important than the potential hearing damage that may result from
8 overpressure. When the wave reaches a receptor, the normal pressure exerted by the atmosphere is
9 increased until the wave has passed. This pressure can be measured in pounds per square foot or as the
10 unweighted sound pressure level in dB. There are no routine sources of impulsive sound in the
11 proposed SRS area. Sonic booms likely to be produced by launch and recovery operations are discussed
12 in Subsection 4.7.2.1, beginning on page 245.

13 Sound is reduced in intensity as it propagates. There are two types of attenuation that usually must be
14 considered in noise assessments—geometric divergence and atmospheric absorption. Geometric
15 divergence results because as sound energy propagates away from the source, it fills an ever increasing
16 volume of space. For the common situation in which the source is small compared with the distance
17 to the receptor, the sound intensity decreases as the square of the distance. Thus, the intensity of the
18 sound measured at a distance of 200 feet is one-fourth the intensity measured at 100 feet. This results
19 in a sound level decrease of 6 dB for each distance doubling. Atmospheric absorption results in the
20 reduction in intensity because of conversion of sound energy to heat energy. For sound of a fixed
21 frequency, the sound level is reduced by a fixed amount per unit propagation distance. For example, if
22 the reduction is 7 dB in one mile, it would be 14 dB in two miles. The level of absorption depends on
23 the frequency of the sound and on the air temperature, pressure, and relative humidity. High frequency
24 sounds are much more strongly absorbed than low frequency. It is common for high frequency sounds
25 to become inaudible as a result of atmospheric absorption while low frequency sounds barely are
26 affected (D. N. May 1978). Impulsive sounds such as those resulting from explosions and sonic booms
27 are rich in low frequencies and, therefore, not strongly attenuated by atmospheric absorption.

28 Sound propagation, especially long range sound propagation, is affected by wind. Propagation in the
29 same direction as the wind results in higher noise levels near the ground, while propagation into the
30 wind results in lower levels.

1 For many applications, it is customary to average sound levels over a 24-hour period. The day-night
2 average sound level (DNL) is computed by increasing the level of sounds that occur between 10 p.m.
3 and 7 a.m. by 10 dBA over their actual values. The purpose of this adjustment is to compensate for the
4 fact that noises are more likely to cause annoyance if they occur during normal sleeping hours.

5 **3.7.2 EXISTING AMBIENT NOISE LEVELS AND SOURCES**

6 The proposed SRS is in a very isolated area with few noise sources. Sources of noise that have been
7 noted during visits to the area by field survey personnel include

- 8 • vehicular traffic on the limited network of unsurfaced roads
- 9 • trains on the AT&SF tracks west of the proposed SRS
- 10 • aircraft noise resulting from passing airliners, light aircraft, and occasional military training
11 flights in the area
- 12 • hum emanating from high voltage electrical transmission lines that pass through the general area
- 13 • natural noise sources including wind, insects, and birds

14 The only existing noise sources in the SRS area have been characterized and measured using standard
15 measurement techniques and instrumentation. These actual measurements constitute the
16 preconstruction baseline noise level and are summarized in Table 16.

Table 16. Summary of Noise Measurements of Existing Sources Near the Proposed SRS

	Source	Measurement Condition	Measured Level ^a	Level under Standard Conditions
1				
2	Background noise level	Calm wind, predominant source: insect wing noise	27 dBA	27 dBA
3	Wind noise	Approximately 10 mph in desert scrub	33 dBA	33 dBA
4	Wind noise	Approximately 20 mph in desert scrub	52 dBA	52 dBA
5	Passing airliner	Boeing 737 at approximately 20,000-ft altitude	32 dBA	32 dBA
6	Military training aircraft	None were recorded during noise characterization measurements		
7	Vehicular noise	Light truck on unimproved road, approximate speed 40 mph	68 dBA at 50 ft	68 dBA
8	Railroad noise	Passing 2-engine train, approximately 40 cars	73 dBA at 125 ft	81 dBA at 50 ft
9	Electrical transmission line hum	Directly beneath line, approximately 40 ft overhead	42 dBA	38 dBA at 50 ft
11	Data Source: Measurements conducted by PSL/NMSU during field surveys in 1996.			
12	a	Values reported are the highest values observed during the recording period.		
13	ft	—feet		
14	mph	—miles per hour		

3.7.3 COMPLIANCE WITH NOISE STANDARDS AND CRITERIA

The location of the proposed SRS is very quiet because it is a rural area where the major human activity is ranching. Day-night equivalent sound levels (DNL) in the area were estimated based on the following assumptions:

- Ten (10) trains pass through on the AT&SF track each day and require an average of one minute to pass any given point on the tracks. Three of those trains pass between 10 p.m. and 7 a.m.
- One-hundred (100) vehicles travel the main north-south road at an average speed of 30 miles per hour (mph). Cumulative duration of the noise events associated with the vehicles is 10 minutes. Ten vehicles pass between 10 pm and 7 am.
- Background noise level is 40 dBA for 10 hours each day (noise level associated with moderate wind).

- Background noise level is 30 dBA for the remainder of each day (noise level associated with light wind).

Vehicle and train counts are higher than actually observed to provide a conservative noise estimate. Based on these assumptions, at points 50 feet from both the road and railroad, the DNL is estimated to be 40 dBA at the SRS site and dominated by natural noise sources. This level is typical of rural areas (DA 1978). The land on which the proposed SRS would be developed is used primarily for grazing. The primary recreational uses include hiking and 4-wheel-drive vehicle operation. Although the land is sparsely populated, it is not pristine and does not have the characteristics usually associated with a wilderness area.

The EPA has set a goal that outdoors in residential areas, the DNL should not exceed 55 dBA (24 CFR §51.102). This goal has no regulatory force. The Department of Housing and Urban Development (HUD) recognizes the desirability of achieving this goal, but allows HUD-sponsored housing projects to be developed in areas with DNL values up to 65 dBA, and as high as 75 dBA under special circumstances (24 CFR §51.104). The proposed SRS location currently is far below the 55-dBA goal.

Although DNL is the noise metric that often is used to characterize the noise environment and impacts of proposed projects, it does not provide a complete understanding of the noise impacts of the SRS. The DNL provides a reasonable characterization when the noise sources are relatively steady or when discrete noise events such as aircraft takeoff and landing operations are frequent and do not exhibit extremely rapid onset. The highest noise levels at the SRS would be associated with space vehicle launches and landings and aircraft operations at the airfield. The SRS is projected to support at most one space vehicle launch and landing per week and an average of no more than two aircraft takeoffs and landings per week. It is important to consider also the duration and frequency of noise events, the peak sound level, and the rate of onset.

3.8 LAND OWNERSHIP AND USE

The proposed SRS facility would cover 247,398 acres or approximately 387 square miles that currently is under the following ownership:

1	• Federal public land	189,209 acres	(76.5%)
2	• Private land	6,767 acres	(2.7%)
3	• New Mexico State Trust Land	51,422 acres	(20.8%)

4 This land is used almost exclusively for cattle ranching. As shown, the vast majority of the land is public
5 land managed by BLM. Approximately 75% lies within Sierra County. This subsection will discuss the
6 present ownership and current and historic uses.

7 **3.8.1 LAND OWNERSHIP**

8 The principal land owner within proposed SRS boundaries is the Federal government. Federal public
9 land in the SRS area is managed under the provisions of the Federal Land Policy and Management Act
10 by the Las Cruces District Office of the BLM. The area is divided into two Resource Areas along the
11 Sierra and Doña Ana county lines (Figure 23). The Caballo Resource Area (previously the White Sands
12 Resource Area) contains the Federal public land in Sierra County, and the Mimbres Resource Area
13 contains the land in Doña Ana County.

Figure 23. Land Ownership

1 The New Mexico State Trust Land (20.8%) is managed by the NMSLO under the applicable New
2 Mexico statutes and regulations. The balance of the land (2.7%) is deeded private holdings. Land
3 ownership is shown in Figure 23.

4 The private land is held by 13 individuals, corporations, or institutions. Eight (8) ranching operations
5 own 3,809 acres (1.5% of the area) of the private land. Five other tracts of privately-owned land
6 encompassing 2,958 acres (1.2% of the area) are located within the proposed SRS boundary. The
7 AT&SF owns 200-foot wide strip of land centered on their tracks encompassing approximately 500
8 acres (0.2% of the area).

9 **3.8.2 LAND USE**

10 Virtually the entire area is used exclusively for livestock production. Federal and State grazing allotments
11 cover 244,440 (98.8%) acres of the SRS area. Grazing allotments and leases have been awarded to eight
12 ranching operations as shown in Figure 24. Two ranching operations own 1,501 acres of land in the
13 immediate vicinity of the SRS and control the grazing allotments in the primary area of initial SRS
14 development. Five currently-occupied private residences are located on these two ranches.

15 Although numerous leasable, locatable, and salable minerals claims have been explored in the past, there
16 are no patented mineral land or active mining claims within the proposed boundary of the SRS
17 (Subsection 3.1.3, beginning on page 94). Some minerals claims have been active as recently as 1992.
18 Much of the area has been leased for drilling and seismic exploration, but all oil and gas leases had
19 expired by 1991. The last active geothermal lease expired in 1975.

20 All experimental irrigated farming operations within the SRS boundaries had ceased by the early 1990s.
21 However, one ranching operation—located approximately 10 miles northwest of the SRS—is
22 experimenting with improvement of grazing land by irrigation.

23 Other current land uses include all of the routine public land uses permitted by the Federal Land Policy
24 and Management Act and State of New Mexico regulations. These uses are discussed in the following
25 subsections.

Figure 24. Grazing Allotments and Private Land

3.8.2.1 Prime and Unique Farmland

The Farmland Protection Policy Act requires a consideration of potential project impacts associated with the conversion of prime, unique, statewide or locally important farmland to nonagricultural uses. The Field Office of the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service located in Truth or Consequences was consulted regarding a determination of the presence or absence of prime or unique farmland within the SRS area. The consultation was based on the submission and completion of USDA Form No. AD-1006, *Farmland Conversion Impact Rating*, as required by the Farmland Protection Policy Act and Executive Order. The Natural Resources Conservation Service determined that no prime or unique farmland are located within the SRS area. A copy of USDA Form AD-1006 is included in Appendix B. There are no local- or State-designated farmlands that are protected under the Farmland Protection Policy Act.

3.8.2.2 BLM Resource Management Plans

The BLM has finalized Resource Management Plans (RMP) for both of the Resource Areas covering the SRS area. The *Caballo (White Sands) Resource Area Management Plan* was published in October 1986 (BLM 1986). The *Mimbres Resource Management Plan* was published in December 1993 (BLM 1993). These RMPs are based on a Record of Decision associated with a combined final EIS and Proposed Resource Management Plan.

The Caballo RMP and EIS evaluated four managerial issues against a spectrum of managerial alternatives. These alternatives encompassed thirteen planning components requiring specific management decisions. The management decisions for these components were expressed in the plan. The Mimbres RMP evaluated four issues and nine categories of management concerns against a spectrum of managerial alternatives. The Mimbres RMP evaluated these issues and concerns against fourteen similar planning components. The BLM (1993) defines an issue as an opportunity, conflict, or problem regarding the use or management of public land or resources. Management concerns are defined as those nonissue-related procedures or land-use allocations which have proven to need modification (BLM 1993).

Three issues common to both plans were special management areas, land tenure adjustment, and access. The fourth Caballo RMP issue was rangeland management. The fourth Mimbres RMP issue was vehicle

management. Management decisions common to both plans included the following planning components:

- Land
- Access
- Minerals
- Livestock grazing
- Vegetation
- Soil, air, and water resources
- Fire management program
- Cultural and paleontological resources
- Wildlife
- Recreation
- Wilderness
- Visual resources

The component unique to the Caballo RMP was wild burros. However, this component has no applicability to the SRS. The two components unique to the Mimbres RMP were riparian and arroyo habitats and special status species. The management decisions contained in the plans with specific applicability to the general area of the SRS are discussed in the following paragraphs.

Areas of Critical Environmental Concern and Special Management Areas

The only Area of Critical Environmental Concern (ACEC) designated in the Caballo RMP is the Sacramento Mountains ACEC located in Otero County, well outside the SRS. The Mimbres RMP designates two ACEC areas in the vicinity of the proposed SRS. Both areas—Rincon ACEC 7 miles southwest and San Diego Mountains ACEC 10 miles south—are located along I-25 between Hatch and Las Cruces. Both are designated ACECs for cultural resource values. Two other ACECs are located further south, between the SRS and Las Cruces. The Robledo Mountains are designated an ACEC for biological, scenic, and recreational values. The Doña Ana Mountains are designated an ACEC for biological, cultural resource, scenic, and recreational values.

Land

All of the land within and adjacent to the SRS proposed boundaries is specified for retention in public ownership. None of the land in either Resource Area is excluded from the establishment of rights-of-way grants. There are no existing land withdrawals or set asides in either Resource Area other than the public water reserves (Figure 23, on page 141).

Minerals

Both Resource Areas are open to minerals exploration and development. The Caballo RMP has established an Area of Critical Mineral Potential on the SRS/WSMR east-central boundary in Townships 15 and 16 South. This area is withdrawn from minerals entry for military purposes.

Livestock Grazing

All of the grazing allotments in both Resource Areas within the SRS are classified as Category M—those allotments with current satisfactory conditions. No specific management decisions are applicable to the SRS area.

Vegetation

The Caballo RMP requirement relating to vegetation is embedded in the rangeland management discussions. The Caballo RMP also contains a list of Standard Operating Procedures for construction on public land. The Mimbres RMP contains specific recommendations for desired plant communities and land treatments.

Cultural and Paleontological Resources

The Caballo RMP establishes a quarter-mile buffer on either side of the well-preserved segments of El Camino Real on public land. No surface disturbing activities—including off-road vehicle (ORV) use—are allowed.

Wildlife

The Caballo RMP states specific goals of developing a Habitat Management Plan or Coordinated Resource Management Plan for providing adequate habitat for mule deer in the Caballo Mountains and studying the distribution and numbers of the pronghorn in the Nutt and White Sands herds. Both management plans have specific universal requirements for protection of wildlife that are applicable to

project activities in the SRS area. These requirements have been incorporated in the standard construction practices section (Subsection 2.1.6.2, beginning on page 54) and biological impacts section (Subsection 4.5, beginning on page 227). The Mimbres RMP has no Habitat Management Plans or Coordinated Resource Management Plans applicable to the SRS area.

Recreation

The Caballo Resource Area is open to ORV use except for the area adjacent to El Camino Real. The Mimbres Resource Area limits ORV use to existing roads and trails. On State Trust Land during large-game hunting season, ORV use is restricted to existing roads and trails.

Wilderness

The Caballo RMP covers the Jornada del Muerto Wilderness Study Area located approximately 25 miles northeast of the SRS area (Figure 4, page 31). The Mimbres RMP covers the Las Uvas Mountains and Robledo Mountains Wilderness Study Areas. These areas are approximately 25 miles southwest and 30 miles south of the SRS area respectively.

Visual Resources

The Mimbres RMP designates the Robledo Mountains as an ACEC for visual resource management (VRM) values. The Robledo Mountains also are a designated Wilderness Study Area.

Riparian and Arroyo Habitats

The Caballo RMP discusses arroyo habitat consideration in conjunction with general management guidance for wildlife. The riparian zones discussed in the Caballo RMP are not located in the vicinity of the SRS. The Mimbres RMP contains specific management objectives for riparian areas and commits to fostering special management attention to arroyo habitats with unique and diverse vegetation.

Special Status Species

The Caballo RMP discusses endangered, threatened, and sensitive species in general terms in several resource-use areas. The Mimbres RMP provides specific objectives for protection and management of populations of—or potential habitat for—Federal and State-listed or candidate species. None of the ACECs in the Mimbres Resource Area include special status species in the designations.

Wildfires

The current BLM policy for the Caballo and Mimbres resource areas is to fight all wildfires on or that threaten public land. Suppression strategies focus mainly on minimizing cost and not acreage burned unless the fires are in highly sensitive areas such as the Organ Mountains. The two management areas recently have begun to use prescribed burning as a management tool. There have been no wildfires in the SRS area since 1979 (BLM 1986, 1993).

3.8.2.3 New Mexico State Trust Land

State Trust Land is managed in accordance with New Mexico statutes and regulations by the State Land Office. Management practices are based on multiple-use activities and roughly parallel BLM management procedures. NMSLO management practices and policies for the SRS area in the past have defaulted to the BLM because of the predominance of Federal land. Following transfer to State Trust Land, the NMSLO will develop and promulgate site-specific management plans for the area. Land-acquisition practices are discussed in Subsection 2.1.6.1, beginning on page 49.

3.9 VISUAL, ESTHETIC, AND RECREATIONAL RESOURCES

The purpose of this section is to provide information on the visual, aesthetic, and recreational resources of the proposed SRS area within southern Sierra County and the northern edge of Doña Ana County, NM.

3.9.1 VISUAL RESOURCES

Visual resources studies review the aesthetic qualities of natural landscapes and modifications to them, the perceptions and concerns of people for landscapes and landscape change, and the physical or visual relationships which influence the visibility of proposed landscape changes. A visual resource analysis was conducted for the proposed SRS site in 1996. The SRS study area for the visual analysis is bounded by the Caballo Mountains on the west, the San Andres Mountains on the east, from the Black Hill area to the Chalk Hills on the north (approximately 12 miles north of Upham), and the Flat Lake/Point of Rocks area on the south.

3.9.1.1 Visual Resource Analysis Approach

The visual resource inventory follows an approach developed and used by the BLM called the Visual Resource Management system or VRM (BLM 1974). The VRM system involves an analysis of three elements

- scenic quality (highly distinctive, moderately distinctive, or undistinctive)
- sensitivity levels (high, moderate, or low)
- distance zones (foreground/middleground – 0–3 miles; background – 3–5 miles to 15 miles; or seldom seen – over 15 miles or screened from view).

Combined, these elements determine Visual Resource Management Classes (VRM Classes I through V).

3.9.1.2 Existing and Updated Inventory Description

The visual resource inventory information describes scenic quality, visual sensitivity, distance zones, and VRM classes.

Scenic Quality

The aesthetic character within the proposed SRS area is neither unique or uncommon for southern New Mexico. The study area is, for the most part, undistinctive in scenic quality (Figure 25). It is comprised of six distinct landforms, delineated as scenic quality rating units as follows:

	Scenic Quality Rating Unit	Scenery Class
1.	Basin Floor—Drainage	undistinctive
2.	Basin Floor—Eolian	undistinctive
3.	Alluvial Fans	undistinctive
4.	Piedmont Slopes	undistinctive
5.	Volcanic Hills/Mesas	moderately distinctive
6.	Foothills of the Caballos	moderately distinctive

Visual Sensitivity (Use Volume and User Reaction)

The main access road, which bisects the proposed SRS area from north to south, currently experiences low use volume. The majority of the existing traffic along this access road is comprised of vehicles associated with the on-site ranches and maintenance vehicles with the AT&SF. According to residents in the proposed SRS area, approximately 20 cars travel the main access road per day. Other estimates indicate approximately 100 cars travel the main access road per day. Another minor road, located south

1 of the Point of Rocks, provides access to a ranch in the southeast corner of the project area and the
2 eastern side of the proposed SRS area.

3 El Camino Real roughly parallels the main access road and railroad alignment. Scattered and dispersed
4 recreation use occurs throughout the proposed SRS site, mostly concentrated near the Upham Hills
5 area, the Point of Rocks, along El Camino Real, and the eastern and central portions of the proposed
6 SRS area. The proposed SRS is not visible from I-25.

7 There are four homesites within the proposed SRS area. These homes are associated with ranch
8 operations on the site and are located

- 9 • in the southeast corner of the project area (a ranch foreman lives at this location; the landowner
10 does not live on-site)
- 11 • at the base of Prisor Hill (east side)
- 12 • at Aleman Draw (a ranch section hand lives in a homesite about three miles southeast of the
13 main homesite)
- 14 • at Jornada Draw on the northern edge of the project area

Figure 25. Landforms and Scenic Quality

1 Other viewers include astronomy club members from Las Cruces who use a location on the southern
2 edge of the project area to take advantage of the dark sky (a location where the lack of artificial lighting
3 improves visibility) for viewing.

4 In the proposed SRS project area, those places with high visual sensitivity are the homesites, El Camino
5 Real (particularly between Upham and Aleman Draw), and the main access road. Prominent landmarks
6 are identified as having moderate sensitivity. They include Prisor Hill, the Upham Hills, and Point of
7 Rocks. The remainder of the proposed SRS area is characterized as having low visual sensitivity.

8 *Distance Zones*

9 Distance zones are defined in Subsection 3.9.1.1, beginning on page 149. Areas delineated as
10 foreground/middleground are along the main access road/El Camino Real corridor, along the minor
11 access road, and from three resident homesites (the homesite at the southeast corner of the proposed
12 SRS area would have views screened by the Upham Hills and other topographic features). The
13 remainder of the project area is identified as background.

14 *Visual Resource Management Classes*

15 Visual Resource Management Classes are derived from combining scenic quality, sensitivity, and
16 distance zone information. There are five levels of VRM. They are

- 17 • Class I—Existing wilderness areas, natural areas, and areas with restricted activities.
- 18 • Class II—Changes in any of the basic elements (form, line, color, texture) caused by a proposed
19 project should not be evident in the characteristic landscape.
- 20 • Class III—Contrasts to the basic elements caused by a proposed project are evident, but should
21 remain subordinate to the existing landscape.
- 22 • Class IV—Any contrast attracts attention and is a dominant feature of the landscape in terms
23 of scale. The contrast (e.g., man-made structures) should repeat the form, line, color, and texture
24 of the characteristic landscape [Note: the BLM has classified the entire proposed SRS area as
25 Class IV].
- 26 • Class V—Applies to areas where the landscape character has been so disturbed that
27 rehabilitation is needed to bring it up to one of the other classifications.

1 There are no Class I, Class II, or Class V areas in the proposed SRS project area. The Class III
2 management area is comprised of a 3-mile area north and east of Prisor Hill and along the main access
3 road/Camino Real corridor. The remainder of the proposed SRS area remains Class IV as delineated
4 by the BLM inventory. VRM classes are shown in Figure 26.

5 **3.9.2 RECREATION RESOURCES**

6 The intent of this section is to identify the existing and proposed recreation and tourism uses of the land
7 surrounding the proposed SRS, discuss the impacts of the proposed SRS on the existing and planned
8 recreation and tourism uses, and describe mitigation measures. The study area is defined as a larger
9 geographic extent than the proposed SRS. The study area extends from Bosque del Apache north of
10 the project area south to Las Cruces (Figure 27). The recreation uses located along the Rio Grande and
11 the I-25 corridor are the focus of this assessment (Figure 27). Tourist attractions include space-related
12 facilities at WSMR and Alamogordo.

13 ***3.9.2.1 Recreation and Tourism Management Plans in the Proposed SRS Area***

14 Recreation opportunities are examined within the regional context surrounding the proposed SRS
15 location. Organized recreation occurs along the Rio Grande west of the proposed SRS site. Dispersed
16 recreation occurs on the proposed SRS site. Recreation planning within the BLM management plans
17 are described as they pertain to the proposed SRS site. Other recreation opportunities in the
18 surrounding area also are described.

19 ***Bureau of Land Management Resource Management Plans***

20 The proposed SRS is located within the boundaries of the Caballo (formerly White Sands) Resource
21 Area Resource Management Plan (RMP) and the Mimbres RMP (BLM 1986, 1993). The Caballo
22 Resource Area RMP covers portions of the proposed SRS within Sierra County while the Mimbres
23 Resource Area RMP pertains to the proposed SRS within Doña Ana County (Figure 28). Recreation use
24 counts in the SRS area are not collected by BLM.

Figure 26. Visual Resource Management Classes

Figure 27. Recreation and Tourism

Figure 28. BLM RMP Recreation Opportunity Spectrum ROS Areas

Caballo Resource Area RMP

BLM land in the Caballo Resource Area portion of the proposed SRS is “open” for ORV use. The BLM utilizes the Recreation Opportunity Spectrum (ROS) Class system as a framework for defining outdoor recreation opportunities. Management objectives for the ROS Classes balances permitted uses with the level of resource protection. The ROS Classes for the Caballo RMP area include “Roaded Natural” for western portions of the proposed SRS, containing existing railroad and unpaved roads, and “Semi-primitive Motorized” for the remainder of the site (Figure 28).

Mimbres RMP

The major form of dispersed recreation in the Mimbres Resource Area portion of the SRS site is hunting. Other dispersed recreation uses include hiking, rockhounding, bird-watching, and off-road vehicle (ORV) recreation. No BLM-developed recreation sites are located at the proposed SRS site. Public land in the Mimbres Resource Area is “open” to motorized vehicles unless an interim standard or emergency closure designation is in effect or is needed to restrict or close areas to protect resources, reduce user conflicts, or enhance public safety. No ROS objectives are identified for the proposed SRS within the Mimbres Resource Area.

3.9.2.2 Recreation and Tourism Areas Within the Proposed SRS Area

Recreation within the study area includes four state parks, two national wildlife refuges, one national monument, one state monument, and parks and recreation sites in Sierra and Doña Ana counties, Truth or Consequences, Williamsburg, and Las Cruces (Figure 27). There also is a wide range of recreation and tourist activities including seasonal events and dispersed recreation uses. Festivals and celebrations occur at Truth or Consequences, Hillsboro, and Hatch. These include Geronimo Days in Truth or Consequences, the Hillsboro Apple Festival, and the Hatch Chile Festival. These are not expected to be impacted by SRS activities.

State Parks

The study area contains four state parks located along the Rio Grande at Elephant Butte Lake, Caballo Lake, Percha Dam, and Leasburg Dam.

National Wildlife Refuges

The study area contains the Bosque del Apache National Wildlife Refuge located north of the proposed SRS, and the San Andres National Wildlife Refuge located southeast.

Sierra County Recreation and Tourism

The Sierra County Interim Land Use Policy Plan states that “Sierra County shall promote and facilitate public and private recreational, cultural, wilderness, and wildlife opportunities compatible with local custom and culture and within the constraints of private property rights and local self-determination” (Sierra County 1991). Elephant Butte Lake and Caballo Lake State Parks are in Sierra County and comprise the largest water recreation area in the state.

Doña Ana County Recreation and Tourism

There are 14 county-maintained parks in Doña Ana County. Las Cruces lists 65 parks and recreation areas containing a variety of facilities. Two ball parks are located in Hatch and one small park in Rincon. The County Fairgrounds and Auto Race Track are located 13 miles west of Las Cruces. The rugged Organ Mountains located east of Las Cruces offer hiking and outdoor recreation. Other locations include Fort Selden State Monument and part of White Sands National Monument. Two rest areas are located along I-25—one near the Elephant Butte Lake exit and one near the Radium Springs exit.

Dispersed Recreation in the Proposed SRS Area

A variety of dispersed recreation is found in the region including hunting, hiking, camping, picnicking, rockhounding, fishing, ORV, bird-watching, panning for gold, equestrian activities, and astronomy. Hunting is the most widespread dispersed recreation use with hunting seasons for game birds, small game, or big game species. The experience of solitude is also a benefit to recreation in the study area. Scattered and dispersed ORV recreation occurs throughout the proposed SRS area but is concentrated on the edges. No estimate is available on the amount of ORV use.

There are several astronomy groups located throughout the region including the Albuquerque, Socorro, Alamogordo, Las Cruces, and El Paso Astronomical Societies. Because sky observation is dependent on the darkness of the sky, the major concern is night lighting.

Evidence of El Camino Real can be seen traversing the western portion of the proposed SRS in the vicinity of the AT&SF and the main access road. It is most visible on the project site from Upham north to Aleman Draw. The National Park Service has determined that El Camino Real is eligible to be designed as a national trail.

Space, Missile, and Military-Related Tourism

Local space, missile, and military-related attractions are located east of the proposed SRS. Exhibitions at the Space Murals, WSMR, and the Alamogordo International Space Hall of Fame and open house events at Trinity Site attract highly specialized, high-technology-business-related travelers, World War II veterans, and younger visitors interested in the high technology, space-related programs.

Current Tourism Levels

The dispersed nature of many recreation activities in the area does not permit comprehensive utilization statistics for activities other than established parks and tourist facilities. For 1995, the number of visitors recorded at the major tourist and recreation facilities were as follows:

- Space-related attractions
 - White Sands National Monument—550,000 visitors
 - Alamogordo Space Center—190,000 visitors
 - White Sands Missile Range—fewer than 5,000 visitors
 - Space Murals—fewer than 8,000 visitors
- Local New Mexico State Parks
 - Elephant Butte Lake—1,754,550 visitors
 - Caballo Lake—311,508 visitors

These two state parks had the highest attendance of any New Mexico state parks in 1994. Combined, they accounted for 47% of all visitors to state parks.

El Camino Real, the north-south route of ancient Spanish trade, is of special interest due to its historical significance and proximity to the proposed SRS site. According to the New Mexico Department of Tourism, the estimated number of visitors to the historical marker near Engle that designates a portion of the trail was 21,284 in 1995. Ranch owners who live at an historic stagecoach stop on the Camino

Real at Aleman Draw report fewer than 20 visitors per month make inquiries concerning the trail (Cain, pers. comm., 1996).

Tourism and Recreation Support Facilities

Tourism is supported by hotels, motels, and campgrounds in the area as shown in Table 17. Occupancy rates for rooms are Truth or Consequences at 80%, Hatch at 80%, and Las Cruces at 72%.

Table 17. Hotel, Motel, and Campsite Availability

Location	No. of Hotel/Motel Rooms	No. of Campsites	Total	% of Total
Truth or Consequences	355	197	552	18.4%
Caballo Lake	—	221	221	7.4%
Hatch	12	—	12	0.4%
Las Cruces	1,906	311	2,217	73.8%
Totals	2,273	729	3,002	100.0%

3.10 SOCIOECONOMIC CONDITIONS

This section describes socioeconomic conditions of the SRS study area and provides information on population, the economy and employment, housing, community services, and tourism and recreation. For purposes of this socioeconomic analysis, the general study area is defined as Sierra and Doña Ana counties.

3.10.1 POPULATION DISTRIBUTION

The U.S. Census Bureau reported that New Mexico's population was 1.52 million in 1990. Since then, the Census Bureau has issued estimates placing the State's population at 1.55 million for 1991, 1.58 million for 1992, 1.62 million for 1993, and 1.65 million for 1994.

Much of the State's population—about 50%—is located within the three Metropolitan Statistical Areas of Albuquerque, Las Cruces, and Santa Fe. Figures from the census of 1980 and 1990 show a statewide population increase of 16.3%, a rate 66.3% higher than the U.S. national average of 9.8% for the same years. Major growth areas include the same metropolitan areas of Albuquerque, Las Cruces, and Santa Fe.

50-Mile Radius of Proposed SRS Site

New Mexico counties included within the proposed SRS site are Sierra and Doña Ana. For 1990 through 1994, estimated population growth for Sierra County was 5.5%. For the same period, estimated growth in Doña Ana County was 13.8%. Population estimates and growth rates for the two counties from 1990 through 1994 are shown in Table 18.

Table 18. Population Estimates for Sierra and Doña Ana Counties

County	1990	1994	1995 Estimate	% Change 90–94	1995 Density (people/square mile)
Sierra	9,985	10,533	10,600	5.5	2.5
Doña Ana	136,507	155,466	158,849	13.9	41.7
New Mexico	1,515,069	1,653,521	1,685,401	9.1	13.8

Data Source: U.S. Department of Commerce, Bureau of the Census

The estimated population densities for 1995 for both counties, also are shown in Table 18. Within the boundaries of the SRS site in Sierra and Doña Ana counties, the Census Bureau population density is estimated to be an extremely low 0.12 persons per square mile. By actual count, less than 20 people reside within the SRS boundaries on a full-time basis for an estimated population density of 0.05 persons per square mile.

Population Centers Near Proposed SRS

Population centers nearest the proposed SRS include Truth or Consequences (T or C), Williamsburg, Hatch, and Las Cruces. Two incorporated communities near the proposed launch site—Truth or Consequences and Hatch—exhibited 1990–1994 estimated growth rates of 0.2% and 3.8%, respectively, well below the State average of 8.9%. During the same period of time, Williamsburg and Las Cruces reported estimated population growth greater than the State average. Population estimates for incorporated communities near the proposed SRS site are presented in Table 19.

Table 19. Population Estimates for Incorporated Communities near Proposed SRS

	Area Name	1990	1994	% Growth 90–94
1	T or C	6,270	6,285	0.2
2	Williamsburg	465	623	34.0
3	Hatch	1,140	1,184	3.9
4	Las Cruces	62,857	71,043	13.0
5	New Mexico	1,515,069	1,653,521	9.1
6	Data Source: U.S. Department of Commerce, Bureau of the Census			
7				

3.10.2 POPULATION CHARACTERISTICS

This subsection provides population characteristics of the State of New Mexico and Sierra and Doña Ana counties. Data are provided for age, ethnicity, income, and poverty levels.

3.10.2.1 Age and Ethnicity

The median age of New Mexico's population is 32.2 years with 29.7% of the population under the age of 18. New Mexico's population has a healthy ethnic diversity given the large Hispanic and Native American populations. Hispanics make up 38.2% of the State's population. The Native American population is 8.9%. Individuals 65 years and older account for 10.7% of the total population.

The median age is 51 for Sierra County and 34 years for Doña Ana County. Both counties have slightly higher female populations with 51.1% and 50.4% respectively. Table 20 presents the age distribution for the two counties and three incorporated communities.

The ethnic distribution of Sierra and Doña Ana counties is dominated by non-Hispanic whites and people of Hispanic origin. Few African-Americans or Native Americans reside in Sierra and Doña Ana counties compared to other areas of the State. The 1990 Census lists Sierra County's non-Hispanic white population at 74.9% with Hispanics making up 23.9% of the

Table 20. 1990 Population by Age for Selected Counties/Incorporated Communities

	Age Range	T or C	Williamsburg	Hatch	Las Cruces	Sierra County	Doña Ana County
1							
2	1 to 15 years	1,088	59	353	14,801	1,756	36,913
3	16 to 24	466	29	185	10,447	6,879	16,260
4	25 to 44	1,124	79	268	19,144	2,184	48,362
5	45 to 64	1,345	115	188	10,698	2,383	21,951
6	65 and over	2,198	167	164	7,036	3,145	12,024

7 Data Source: U.S. Department of Commerce, Bureau of the Census

8 county's population. By contrast, the 1990 Census reports a 40.6% non-Hispanic population for Doña
 9 Ana County with Hispanic making up 56.3% of the county total. The ethnic and racial makeup of New
 10 Mexico and the project area are shown in Table 21.

Table 21. 1990 Population by Ethnicity and Race for New Mexico and Selected Communities

Community/County	Non-Hispanic					Hispanic				
	White	Black	Native	Asian	Other	White	Black	Native	Asian	Other
11 T or C	4,686	6	80	12	6	1,023	28	11	0	364
12 Williamsburg	366	0	0	0	0	85	0	0	0	10
13 Hatch	314	0	0	0	0	844	0	0	0	0
14 Las Cruces	30,895	1,111	393	842	51	24,029	67	113	25	4,600
15 Sierra County	7,433	13	80	12	6	1,898	28	14	0	428
16 Doña Ana County	55,031	1,962	824	1,265	109	68,727	157	130	81	7,224

18 Data Source: U.S. Department of Commerce, Bureau of the Census

19 *Income and Poverty*

20 Median household income figures for both Sierra and Doña Ana counties fall below the State average.
 21 In 1990, the U.S. Census reported a median household income for New Mexico was \$24,089. By
 22 comparison, Sierra County reported a median household income of \$15,612, or 35.2% below the State
 23 average. Doña Ana County reported a median household income of \$21,859, or 9.2% below the State
 24 average.

25 In 1990, some 20.2% of the State's population was categorized at or below poverty level. For that same
 26 year, 19.0% of Sierra County's population was living at or below poverty and 25.6% of Doña Ana's

1 population was living in poverty. For 1990, the per capita poverty level was \$6,652. For a family of four,
2 the level was \$13,359.

3 Figures for the Hispanic populations of Sierra and Doña Ana counties are below that of the counties
4 as a whole. For Sierra County, 1990 Census figures show per capita income for Hispanics was \$6,489,
5 and per capita income for the county at large was \$10,124. Doña Ana County reported Hispanic per
6 capita income of \$6,056 and overall per capita income of \$9,374.

7 The number of individuals living in poverty as reported to the Census Bureau also shows disparity based
8 on Hispanic ethnicity. In Sierra County, 30.4% of Hispanics are living in poverty compared to 19.0%
9 for the total population. In Doña Ana County, 34.7% of Hispanics live in poverty compared to 25.6%
10 of the overall population. Table 22 shows per capita income by Hispanic ethnicity for the study area as
11 reported for 1989.

12 ***3.10.3 ECONOMIC ACTIVITY AND EMPLOYMENT***

13 This section provides information on employment and the economy of the SRS study area. The
14 information is provided for the State and Sierra and Doña Ana counties.

15 ***3.10.3.1 Economic Activity***

16 Historically, the State economy has depended on commercial agriculture and ranching. This compares
17 to today's economy, which relies heavily on government, oil and natural gas extraction, tourism,
18 agriculture, mining, and technology. Economic sectors showing the greatest impact are trade, services,
19 and government, which together account for more than 75.3% of all jobs. The government's role in the
20 New Mexico economy is very important. In 1994, Federal, State, and local government employment
21 accounted for 24.7% of all nonagricultural jobs, employing more than 163,100 people. The service
22 sector employs 26.9% (176,800 people), and trade-related employment makes up 23.7%
23 (155,800 people).

24 ***Sierra and Doña Ana Counties***

25 The original economy of Sierra County and its county seat, Truth or Consequences, was driven by gold
26 and silver mining. When the deposits were depleted, the area was largely

Table 22. 1989 Income by Municipality and County

City/County	Non-Hispanic				Hispanic			
	Median Household Income	Per Capita Income	% Population Below Poverty	% Unemployment 1994	Median Household Income ^{1,2}	Per Capita Income	% Population Below Poverty	% Unemployment 1994
Truth or Consequences	\$14,090	\$9,302	20.7	n/a	\$10,000–\$14,999	\$6,546	34.2	n/a
Williamsburg	\$14,583	\$8,497	20.8	n/a	\$10,000–\$14,999	\$7,162	15.8	n/a
Hatch	\$12,975	\$5,864	40.2	n/a	\$10,000–\$14,999	\$4,693	50.8	n/a
Las Cruces	\$23,648	\$11,175	22.6	n/a	\$15,000–\$24,999	\$7,163	31	n/a
Sierra County	\$15,612	\$10,124	19	5.5 ¹	\$10,000–\$14,999	\$6,489	30.4	n/a
Doña Ana County	\$21,859	\$9,374	25.6	8.0 ¹	\$15,000–\$24,999	\$6,056	34.7	n/a
New Mexico	\$24,089	\$11,246	20.6	6.3 ¹	\$15,000–\$24,999	\$7,542	27.8	7.6 ¹

1 Data do not allow the precise value to be determined. Value is in the range from \$10,000–\$14,999.
2 Data do not allow the precise value to be determined. Value is in the range from \$15,000–\$24,999.

Data Source: U.S. Department of Commerce, Bureau of the Census
New Mexico Department of Labor, Economic Research and Analysis

abandoned. Today, income is derived from the sizable retired community residing in Truth or Consequences. Government spending and tourism associated with Elephant Butte and Caballo reservoirs also are important to the economy of Sierra County. Employment in Doña Ana County is dominated by retail trade, services, and government. Agriculture once dominated this region but now accounts for only 8% of the work force. Table 23 indicates trends in employment by sector for Sierra and Doña Ana counties. Table 24 presents similar data for the incorporated communities.

Table 23. Employment by Sector

	Sierra County			Doña Ana County		
	1992 ¹	1995 ²	Percent Change	1992 ¹	1995 ²	Percent Change
Farm	332	*	4.5	2,513	0	6.1
Agricultural services, forestry,	82	*	-9.8	2,464	0	2.3
Construction and mining	101	167	65.3	2,400	3,300	37.5
Manufacturing	*	19	46.1	2,800	2,600	-7.1
Transportation, communica-tion, and utilities	*	161	42.5	1,500	1,750	16.6
Wholesale trade	41**	52	26.8	1,100	1,250	13.6
Retail trade	487	599	23.0	8,500	9,400	10.6
Services	502	565	12.5	8,500	10,300	21.2
Government	724	850	17.4	17,900	18,400	2.8
Other	225	120	-46.7	1,600	1,900	18.7

* Not included in data

** Estimated from summary wholesale and retail figures provided by NM Department of Labor

1 Annual Average

2 NM Dept. of Labor, June 1995

Data Source: New Mexico Department of Labor, Economic Research and Analysis

3.10.3.2 Labor Pool Characteristics

The percentage of people 18 and over with a high school diploma or equivalent in Sierra and Doña Ana counties is 51.4% and 50.3% respectively. Individuals holding a bachelor's degree or higher account for 6.5% of the population in Sierra County and 12.8% in Doña Ana County.

Table 24. Employment by Sector—Incorporated Communities, 1990¹

Industry	T or C	Williamsburg	Hatch	Las Cruces
Agriculture, forestry, fisheries	24	0	129	517
Mining	43	6	0	37
Construction	158	3	25	1,616
Manufacturing, nondurable goods	22	0	5	787
Transportation	46	6	14	558
Communications and public utilities	50	6	4	639
Wholesale trade	38	3	14	532
Retail trade	430	22	62	5,305
Finance, insurance, and real estate	137	12	12	1,535
Business and repair services	74	4	6	1,289
Personal services	113	2	5	813
Entertainment and recreation services	28	0	2	404
Professional and related services				
Health	190	16	11	2,029
Educational	87	14	30	4,485
Other	88	3	0	2,023
Public administration	134	18	20	3,125
1 Employed persons 16 years and over				
20 Data Source: U.S. Department of Commerce, Bureau of the Census				

The greatest differences in labor pool characteristics between Sierra and Doña Ana counties is Doña Ana's relatively high number of Federal government workers and unpaid family workers. The smallest differences in the two-county labor pool is measured in the number of self-employed workers and those working for local government agencies. Labor pool characteristics are shown in Table 25.

In Sierra and Doña Ana counties, the civilian labor force accounts for less than 50% of the counties' populations. The high percentage of retirees and full-time students in the area explains these lower labor force participation rates. Unemployment in Sierra County in 1994 was estimated at 5.5%. The unemployment rate in Doña Ana County in 1994 was estimated to be 8.0%.

3.10.3.3 Other Site Related Economic Activity

Figures from the 1992 Census of Agriculture show Sierra County with 207 farms and ranches with some 115,128 acres of land are under irrigation. Livestock is raised on 76 county ranches.

Table 25. Labor Pool Characteristics, 1990

	T or C	Williamsburg	Hatch	Las Cruces	Sierra	Doña Ana
1 Private for-profit wage and salary	977	60	232	15,145	1,679	31,864
2 workers						
3 Private not-for-profit wage and	87	0	7	1,338	128	2,234
4 salary workers						
5 Local government workers	166	23	11	2,196	270	3,686
6 State government workers	210	19	30	3,493	379	6,460
7 Federal government workers	49	6	23	2,615	145	4,763
8 Self-employed workers	220	7	42	2,029	410	3,906
9 Unpaid family workers	6	0	0	102	6	146

Data Source: U.S. Department of Commerce, Bureau of the Census

Industrial employment—inclusive of agriculture, forestry, and fisheries—totaled 128 people in Sierra County during the 2nd quarter of 1995.

In Doña Ana County, the Census reports 1,271 farms and ranches with irrigated land covering 151,917 acres. Livestock is raised on 89 ranches. Industrial employment—inclusive of agriculture, forestry, and fisheries—totals 5,839 people in Doña Ana County during the 2nd quarter of 1995.

3.10.4 HOUSING AND COMMUNITY SERVICES

This subsection outlines existing housing conditions within Sierra and Doña Ana counties. Community services in the nearby municipalities of Truth or Consequences, Hatch, and Las Cruces are examined for existing service capability. Only those community services that potentially could be affected by construction or operation of the proposed SRS facility are addressed in this subsection.

Housing

Based on the most recent survey of local housing structures and availability, existing housing units in Sierra and Doña Ana counties number 55,605. Mobile home units, a housing type typically occupied by construction workers from outside the region, number 14,739 with existing vacancies of 2,064 or a rate of 14%. Tables 26 and 27 show housing units in Sierra and Doña Ana counties by type and occupancy.

Table 26. Housing Units, 1990

	City/County	Total Housing Units	Year-Round Units	Owner-Occupied Units	Renter-Occupied Units	Total Housing Vacancies
1	T or C	3,652	3,475	1,939	894	819
2	Williamsburg	265	256	177	47	41
3	Hatch	492	490	292	114	86
4	Las Cruces	25,676	25,602	13,382	10,415	1,879
5	Total	30,085	29,823	15,790	11,470	2,825
6	Sierra County	6,457	5,460	3,247	1,181	2,029
7	Doña Ana County	49,148	48,924	29,084	15,945	4,119
8	Totals	55,605	54,384	32,331	17,126	6,148
9	Data Source: U.S. Department of Commerce, Bureau of the Census					
10						

Table 27. Mobile Homes, 1990

	City/County	Mobile Home Units	Mobile Home Vacancies
11	T or C	1,156	254
12	Williamsburg	114	18
13	Hatch	127	24
14	Las Cruces	2,845	178
15	Total	4,242	474
16	Sierra County	2,369	853
17	Doña Ana County	12,370	1,211
18	Totals	14,739	2,064
19	Data Source: U.S. Department of Commerce, Bureau of the Census, 1990		
20			

21 Within the two-county area, 26.7% of occupied housing units are rental units. Sierra County's rental
 22 units are 21.6% of all occupied housing. In Doña Ana County, the percentage is higher with 32.6%.
 23 Also, Sierra County lists 42.0% of vacant housing as mobile units. Doña Ana lists 50.1% of vacant
 24 housing as mobile units.

25 *Community Services*

26 *Law Enforcement Officers*

27 Table 28 shows the ratio of law enforcement officers to population in the project area. The range is
 28 from 1.9 officers per 1,000 inhabitants in Las Cruces to 0.9 in Doña Ana County.

Table 28. Ratios for Police Coverage

	City/County	1994 Est. Population	Number of Officers/Deputies	Ratio of Police/Deputies to Population	Number of Officers/1,000 Inhabitants
1					
2	T or C	6,285	12	1 per 524	1.9
3	Hatch	1,184	4.5	1 per 263	3.8
4	Las Cruces	71,043	126	1 per 564	1.8
5	Sierra County	10,533	11	1 per 958	1.0
6	Doña Ana County	84,423	80	1 per 1,055	0.9

7 Data Source: State and local law enforcement agencies

8 The Doña Ana County Sheriff's Department maintains a permanent substation in Hatch that covers
9 the entire northern half of the county. The number of Doña Ana Deputies permanently assigned to this
10 office is shown under Hatch in Table 28. According to the Federal Bureau of Investigation (FBI)
11 statistics, Truth or Consequences and Las Cruces are underserved relative to the average number of
12 officers per 1,000 inhabitants for the Southwest region.

13 *Fire*

14 The closest fire departments with paid, full-time staff members are in Truth or Consequences and Las
15 Cruces. These fire departments are relatively well equipped because 0.25% of revenues from New
16 Mexico sales taxes are set aside for the purchase of fire equipment. The Hatch fire department is the
17 largest volunteer fire department in the area. It averages between 18 to 25 people on call annually. All
18 of the other communities in the SRS area also are served by small volunteer fire departments.

19 *Schools*

20 Enrollment in schools for Sierra and Doña Ana counties is provided in Table 29. The numbers were
21 taken from the 1990 census and include children 3 years and older.

Table 29. 1990 Public and Private School Census for Sierra and Doña Ana Counties

		Sierra	Doña Ana
1	Enrolled in preprimary school		
2	Public	45	943
3	Private	0	426
4	Enrolled in elementary through high school		
5	Public	1,319	27,215
6	Private	45	900
7	Enrolled in college		
8	Public	139	16,263
9	Private	38	741

According to the 1990 census, there were 193 people employed in Sierra County in the field of educational services. Doña Ana County there were 8,123 people employed in educational services. The average student/teacher ratio for the local area schools districts is 23:1 in Truth or Consequences, 19:1 in Hatch, and 21:1 in Las Cruces.

During the 1993–1994 school year, Sierra County experienced a student growth rate of 5.1%. This is compared to an increase in public school enrollment for the State New Mexico of 1.9%. Enrollment at New Mexico State University, located in Las Cruces, decreased 0.2% during the same time period. The 1996 student population for the area is shown in Table 30. Current funded construction will add a new 300–350-student capacity elementary school in Hatch and a new 1,000-student capacity middle school in Las Cruces.

Table 30. 1995–1996 Student Population

		Truth or Consequences		Hatch ¹		Las Cruces	
	Grade Level	No. of Students	Capacity	No. of Students	Capacity	No. of Students	Capacity
	K–5	932	Full	767	Under	10,715	Over
	6–8	452	Full	361	Under	5,242	Over
	9–12	467	Under	363	Under	6,320	Over
	Total	1,851		1,491		22,277	

¹ Data from Hatch School District was not specific. Student population is 1995.

Data Source: Bureau of Business Research and Services, NMSU

For the fiscal year 1993–1994, public school spending in Truth or Consequences was \$6 million. For the same period, the spending in Las Cruces was \$68 million. Truth or Consequences has a public

1 school bond referendum planned for 1998 for the construction of a new elementary school. Las Cruces
2 has a bond referendum that is before the public for the November 1996 election. The \$3.5 million
3 proceeds for Doña Ana County will provide renovations and additions to existing buildings and new
4 classrooms in all locations.

5 *Medical*

6 There is one person working in health service for every 39.5 people in Sierra County and one for every
7 37.0 people in Doña Ana County. An emergency medical treatment satellite center is located in Hatch.
8 Memorial Medical Center in Las Cruces is the largest hospital in the two-county area with approximately
9 1,250 employees. It has approximately 425 beds with an occupancy rate of 73.5%. It has the second
10 busiest emergency room in New Mexico and operates a helipad. However, this emergency room is not
11 classified as a trauma center. Medical cases that need to be treated in a trauma center are transported
12 to Albuquerque or El Paso by aircraft or helicopter.

13 **3.10.5 TRANSPORTATION AND TRAFFIC**

14 *Transportation*

15 In Sierra County, 78.8% of those 16 years and older drive to work alone in a vehicle, 14.8% car pool,
16 and 4.4% walk to work. In Doña Ana County, 76.0% of those 16 years and older drive to work alone,
17 approximately 17.4% car pool, and 3.5% walk.

18 *Traffic*

19 State Highway 51, the primary access road from the Truth or Consequences area to the proposed SRS,
20 is approximately 18 miles long. The road runs west to east from Business 25—which runs through the
21 heart of Truth or Consequences between I-25 Exits 79 and 75—to the community of Engle. Traffic
22 along this road varies greatly depending upon its proximity to Truth or Consequences or Engle. Neither
23 the New Mexico State Highway and Transportation Department nor Sierra County have conducted a
24 comprehensive traffic count along the entire course of this road for many years. However, Sierra County
25 estimates that near Truth or Consequences, NM 51 averages 6,764 cars per day. This number is
26 estimated to diminish to 1,555 near Elephant Butte Dam Site. There is very little traffic on the road
27 from Elephant Butte Dam Site to Engle. From Engle to the proposed SRS site, access is over a series
28 of paved and unpaved Sierra County secondary roads.

1 The primary access to the SRS operations and SCCF areas from the south is through an existing
2 network of Doña Ana and Sierra county dirt roads. This network links Exit 32 from I-25—near
3 Rincon—with NM 51 at Engle. During 1994–95, a major construction project on I-25 took place
4 between Hatch and Rincon. Many of the construction vehicles used Exit 32. Therefore, the last New
5 Mexico State Highway and Transportation Department count that does not include the inflationary
6 construction traffic is for 1993. For that year, the average daily traffic count for Exit 32 was 30–35
7 vehicles (NMSH&TD, pers. comm., 1996).

8 The majority of traffic between Truth or Consequences and Las Cruces is on I-25. This stretch of
9 highway currently is underused (NMSH&TD, pers. comm., 1996).

10 *Air*

11 The nearest commercial passenger service is provided by Mesa Airlines, which flies into Las Cruces
12 International Airport and Alamogordo/White Sands Regional Airport. The nearest of the two
13 commercial airports is Las Cruces, which serves an average 45 passengers a day. The Las Cruces airport
14 maintains three runways—two 7,500-foot runways and one 6,000-foot runway. The largest commercial
15 airplane that currently serves Las Cruces seats 19 passengers, but the airport is equipped to handle
16 B727/B757-sized aircraft.

17 The El Paso International Airport, which is owned and operated by the City of El Paso, offers full
18 commercial passenger service by six major transcontinental and international carriers. The U.S. Customs
19 Service provides inspection and clearance for international flights.

20 **3.11 ELECTROMAGNETIC RADIATION**

21 There are no significant sources of electromagnetic radiation (EMR) within the proposed SRS. There
22 is some use by the public and by official organizations of Citizen's Band, Amateur Band, and Public
23 Service Band radio transmitters within or near the area. These bands are reserved for their respective
24 uses. A commercial FM-radio transmitter is located about 15 miles south of the proposed SRS. A
25 number of transmitters and repeaters for various frequencies are located in the Caballo Mountains. On
26 the southwest corner of WSMR, the NASA TDRSS (Tracking and Data Relay Satellite System) ground
27 station operates highly directional Ku- and S-band transmitters and receives omni-directional signals in
28 these bands. All of these sources are properly licensed and controlled. WSMR uses a variety of radio

1 devices that operate on frequencies reserved for use by military and other organizations that conduct
2 tests there.

3 As in any area, there is a certain amount of stray EMR in or near the proposed SRS. Sources include
4 power lines that pass through the area, spark noise from vehicles, stray radiation emitted by various
5 electrical and electronic devices, and lightning.

6 An important consideration with regard to EMR is the potential for interference with the Very Large
7 Array (VLA) radio observatory located approximately 100 miles northwest of the proposed site. The
8 VLA is the world's premier radio astronomy facility. It's location was chosen partly for its quiet EMR
9 environment. The observatory has receivers that operate in seven defined bands in the ultrahigh
10 frequency and microwave regions. These are summarized in Table 31.

Table 31. Frequency Bands and Ranges Used for Astronomical
Observation at the VLA

	Band	Frequency Range (GHz)
11		
12	P	0.30 – 0.34
13	L	1.34 – 1.73
14	C	4.5 – 5.0
15	X	8.0 – 8.8
16	U	14.4 – 15.4
17	K	22 – 24
18	Q	40 – 50
19	GHz — gigahertz	
20	Data Source: VLA World Wide Web Page	
21	(http://www.nrao.edu/doc/vla/html/VLAintro.shtml)	

22 Parts of these bands are assigned for a wide variety of uses. Frequency ranges used by the VLA were
23 selected in part to minimize interference.